HANDBOOK FOR

ARCHITECTS AND BUILDERS

PUBLISHED
UNDER THE AUSPICES
OF THE

Illinois Society of Architects

VOL. XXV. 1922

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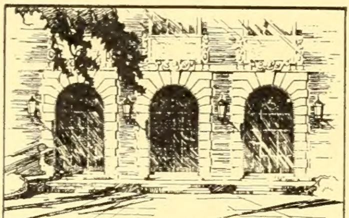

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HANDBOOK

FOR

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PUBLISHED
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ILLINOIS SOCIETY OF ARCHITECTS

TWENTY-FIFTH YEAR
1922

Emery Stanford Hall, Editor

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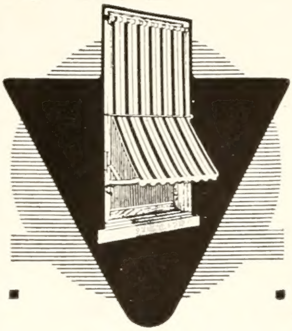

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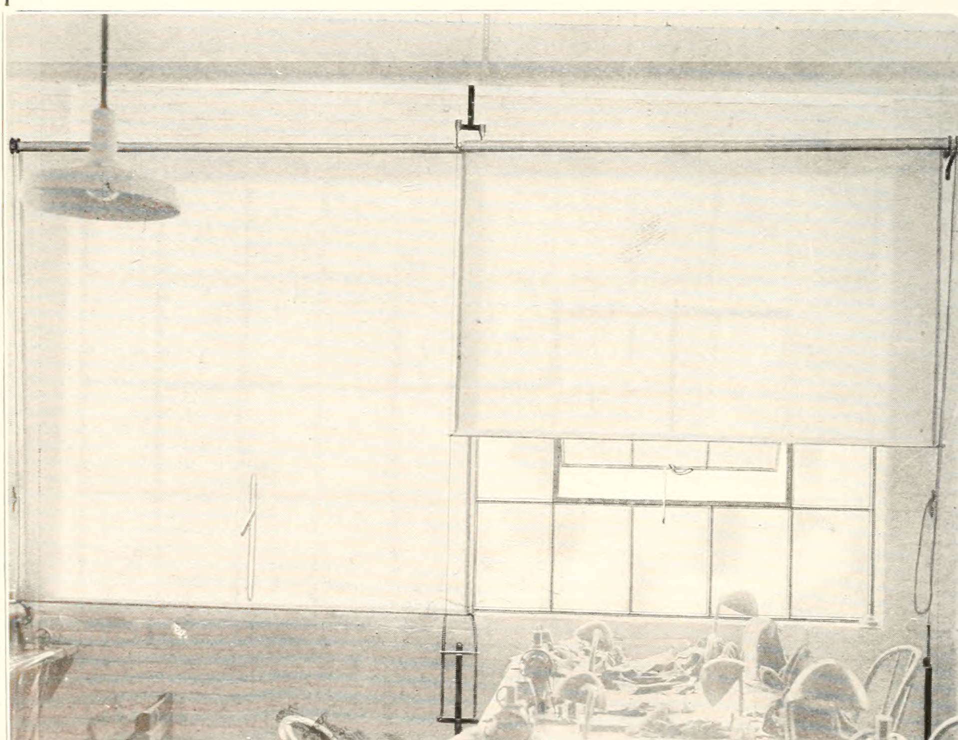

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PREFACE

WE TAKE considerable pride in presenting the Twenty-fifth Edition of the Handbook for Architects and Builders to the Architectural and Engineering Professions and those interested in Building Construction.

On this occasion, the twenty-fifth anniversary of this publication, it is impossible to resist the temptation to express satisfaction with the work that has been accomplished by this publication in the last quarter of a century.

Starting with a volume of two hundred and eight pages, we have grown to this volume with six hundred and forty pages. Beginning, as the annual of the old Chicago Architect's Business Association, which has since been changed to the Illinois Society of Architects, with a publication designed peculiarly to meet the needs of the architects and contractors of the City of Chicago, the Handbook first grew from a medium to serve the needs of the architects of a single city to one to serve the needs of the architects of the State. It has now quite outgrown the confines of a circulation among the architectural profession in Illinois and has not only also reached a large circulation among contractors and structural engineers but is eagerly sought by architects, libraries and Societies throughout the United States, as well as numerous foreign countries.

This year many valuable changes have been made to increase the value of the publication, the matter of using dull finished paper in certain parts of the publication has met with the approval of its readers and is again used. The new codification of the Building Code on which a Special Committee of the City Council and Special Assistants of the Corporation Counsel have been at work for many months is reproduced herein, and while the law has not been changed, certain sections have been added that were known as special ordinances and which had no section numbers, also certain sections that had to do solely with Health and Fire Prevention Departments were taken out and placed with the departments to which they belonged. The section numbers have all been changed and a much more comprehensive Building Ordinance is the result of this work.

Our pages, this year, will also contain the findings of the National Board of Jurisdictional Awards in the Building Industry as many of our readers have requested that this be added. The Rules of the Commonwealth Edison Co. pertaining to Electric Service, Meters and Wiring, the Gas Company's rules for Gas Fitters have been materially changed as well as the Electric Code of the City Electrical Departments.

We welcome as contributors, Col. H. C. Boyden, C. E., who has contributed an article on Recent Developments in Concrete, and Mr. Guy Shaw on Violet Rays. The balance of the staff of contributors continue in the various departments and are composed of the following: Homer Linn, M. E.; Dr. E. Vernon Hill, Aerologist; R. W. Lindsay, Chemist; Leo H. Pleins, Architect and Sanitary Engineer; Fred J. Postel, M. E.; Frank J. Llewellyn, A. S. C. E.; Frank Chambers, Smoke Prevention Assn. of America; Benjamin E. Winslow, Member A. I. S. and W. S. E.

Diligent care and caution have been exercised in editing and preparing the matter published in the Handbook for Architects and Builders, but we realize that notwithstanding this, inaccuracies in judgment as to the selection of matter and mistakes in statement of fact may have crept into this work and for such faults we ask the indulgence of our readers and that they forward to us their friendly criticism and suggestions, that succeding editions may be improved.

The Handbook for Architects and Builders covers a peculiarly exclusive field and is a recognized reference work for everyone interested in Architecture and Building. The demand for this publication is constantly increasing and it has become almost indispensable to Architects, Engineers, Contractors and Builders.

Our Classified Index furnishes the Architect with a list of those engaged in the manufacture and sale of material and the contracting business. We have exercised our best judgment in the selection of those represented in our book and we urge Architects desiring the names of contractors and material firms to use this list.

¶ We call especial attention to the business announcements on these pages. We have accepted only such houses as are absolutely first-class and reliable. In the light of knowledge which we have upon the subject, acquired by experience, we feel that we have used every discretion in the matter of those represented herein

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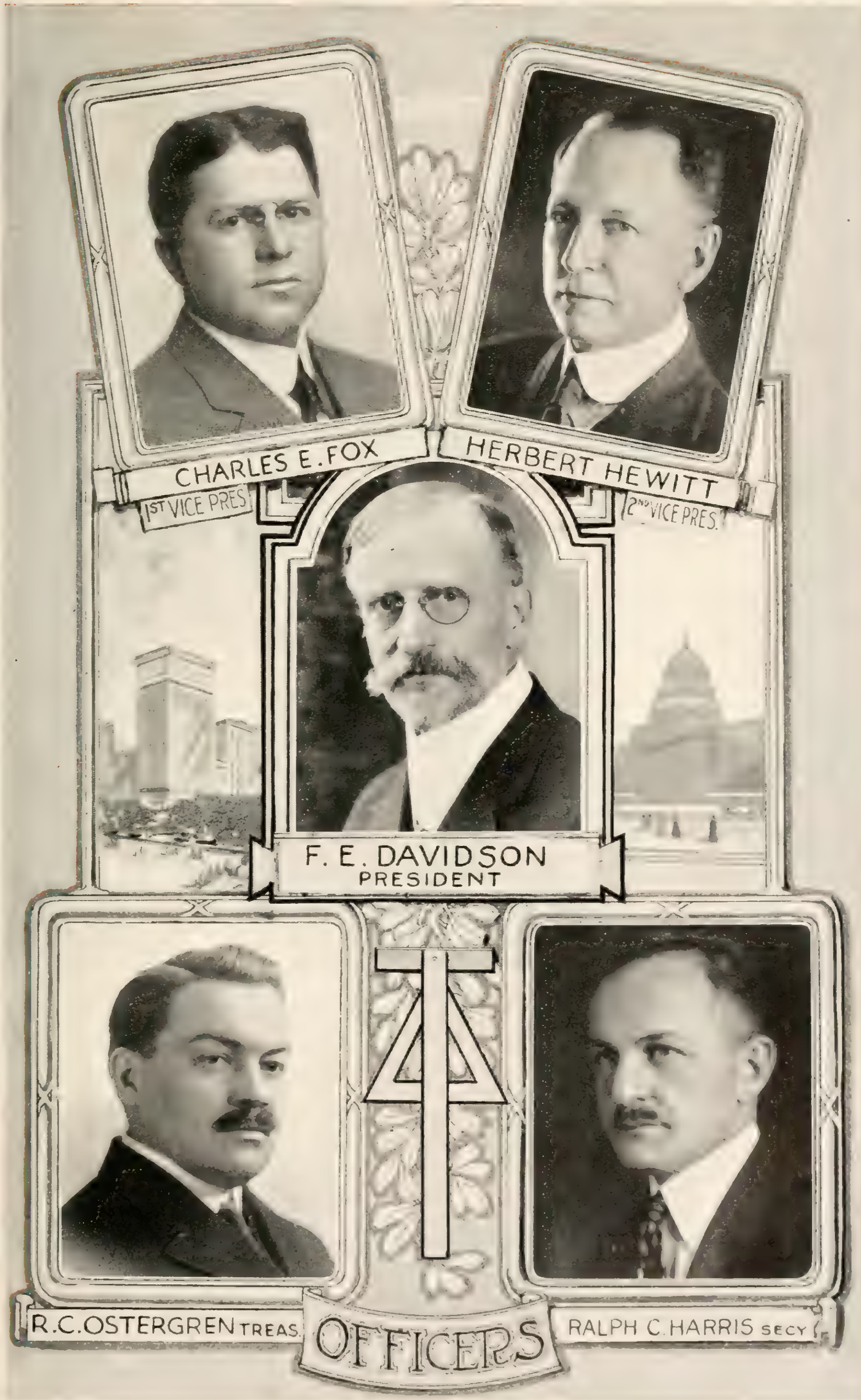
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EDITORIAL.

THE MAKING OF AN ARCHITECT.

The troubles of an architect are manifold. Yea, his birth pains are terrible and beyond belief, while his growing pains are many times worse. When he is born he passes thru three days of grueling examinatory pain, yea, even sometimes six, and if by reason of early educational neglect his knowledge is very incomplete, it may be even nine. Following birth comes a series of periods of development.

First—The sad days of waiting when clients come not nigh but pass by on the other side.

Second—There comes the period of active job hunting which brings forth a crop of piker clients. Clients who tell their neighbors that "I have designed this house,—I have only called on an architect to draw it up in order that I might secure a building permit"—clients that insist on plan requirements for a ten thousand dollar house when they can only spend five thousand—clients that even declare that it does not cost anything to run an architect's office—clients that seem to believe that the great privilege of serving them should be considered ample pay for all services rendered.

Third—Following the period of frantic solicitation, there appears the speculative builder client, the wonder man who buys his plans for fifteen dollars per flat, and then uses them to build fifteen flat buildings, not one of which follows the plan—why should he employ an architect to supervise his building? It is surely easier to depart from the plans without an architect than with one.

Fourth—In the wake of the speculative builder stage comes the period of high finance. The period when the subtle-promoter appears on the scene. So-and-so has heard that he can acquire certain valuable lots by persuading the owner thereof to pass him title to same and accepting third mortgage bonds as security therefor. All that is required is that an architect shall prepare plans, estimates and numerous, gaudy, impossible water color sketches for a thirteen story apartment building, secure a loan sufficient to build it, pay for the lot on which it is to stand, fee the promoter, etc. In consideration of this service on the part of the architect, the subtle-promoter will use his great influence to secure the employment of the architect at the regular recommended minimum Institute rates for architectural services only, otherwise, all obligations do become null and void and subtle-promoter will never have known the architect, except as a poor unfortunate for whom he, the promoter, hath done many favors.

Fifth—After the period of high finance, the architect enters the period of sophistication and becomes either a pessimistic, sour, discouraged crab or an optimistic, discerning, successful architect. If he becomes a crab no one can do business with him and reduced to starving condition, he will soon seek an untimely grave. With funeral flowers, is ended the budding genius of an architect who could not sell his wares. If he becomes a successful architect, it is because he has learned how to sell a good thing for what it is worth.

Salesmanship.

Training in salesmanship is the one essential thing which is so often omitted from the education of an architect. Inadequacy in this line accounts for the frequent victimizing of members of this profession by the various agencies of fraud that seem to operate in every community. Why are architects often defrauded of their just dues?

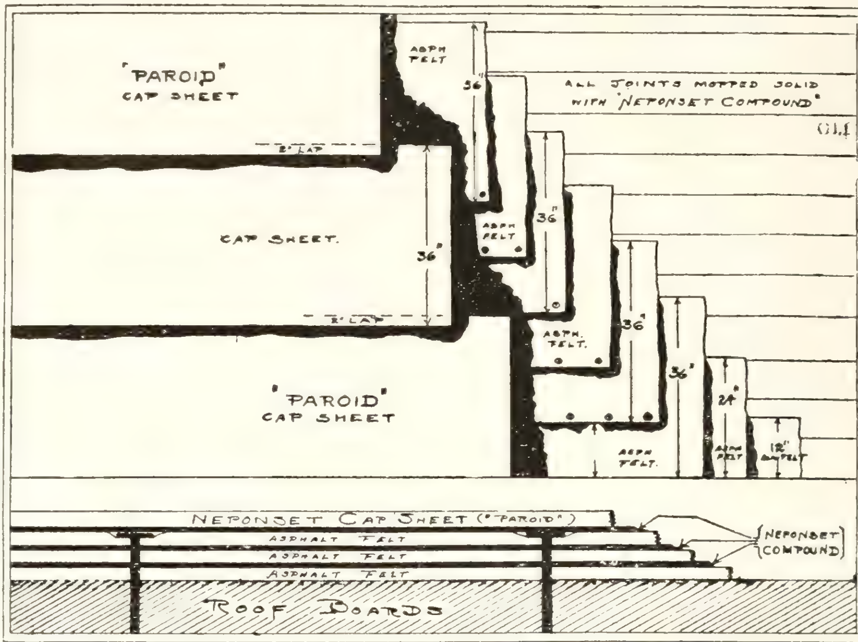
First—Because they have something worth while to give. If architects did not have something worth while to give, they would not ever be the victims of the smooth promoter or unscrupulous builder. Whoever heard of a farmless hick being the victim of con-men. If he were not a good farmer, he would not be a farm owner. If he were not a farm owner he would constitute no temptation to the fraudulent schemer.

Second—Because architects as well as farmers have been too greatly specialized, either too much design and too little construction, or too much construction and too little design. Plenty of technique in both design and construction; no general business. How many architects know the real meaning of overhead expense, or how much it actually costs to get out a job? Else why should there be so many architects offering to render service for less than it actually costs to produce that service.

Third.—No adequate advocate. The public has so long assumed that anything worth having is adequately presented that it believes that everything is adequately presented. The public rates things as they are presented, not as they are. There is no use crying about it or dening the fact. It is so and must be made the best of. The public can no longer seek out that which it has need for and find it because the public has lost, outside of its own specialized line, the art of research. The incompetent architect gets the business, not because he is technically incompetent, but because he employs competent sales skill, sales skill which if applied to the sale of real competent, honest-to-goodness service would get much larger returns for efforts expended. On account of the personal nature of architectural service, the individual practitioner may often be embarrassed in a personal presentation of the merits of architectural service, for he may find it difficult, if not impossible, to separate the personal from the abstract. It is to be hardly expected that those technically expert architecturally should be likewise technically expert salesmen. In fact the natural assumption would be that mental and temperamental qualities peculiarly adapting the individual for real success in architectural production could not be expected to be common with those natural qualities that would make a successful salesman.

Let the facts be faced as they are, what is the solution? There are several solutions from which to choose; the following suggest themselves. The profession must choose and proceed.

First—Architectural Organizations could be formed consisting of specialists in architectural design, construction, specification writing, business, supervision and salesmanship. Experience shows that combinations of this kind which do now exist are generally



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unable to produce as high a type, from an artistic standpoint, of architectural production as separate practitioners. Probably this is due to universal tendency for the salesman, member of the firm to assume that because he brings in the business he ought to dominate production, a function, which by the very nature of things, he is incompetent to perform.

Second—Individual architects or firms might employ salesmen to dispose of their product in just the same way as merchandise is sold. These salesmen to have nothing to do with the professional work of the firm and no control over its production. In such cases they would be required to sell on merit of past performance, education and experience of personnel. This might be a practical method, but from the present viewpoint, it would no doubt be viewed as unethical. Laying aside all preconceived notions and looking at the matter purely from the standpoint of actual known fact, this second possible solution is not any more open to question than the first. Both are now practiced to a limited extent.

Third—Architects might combine in a professional association and sell the architectural profession to the public in the same manner as is now done by the various manufacturing and material trade associations. But if this method were used means would have to be found to finance this association on the same broad scale as that on which the great trade associations that now push the sale of the products of the dominant building material interests. For illustration, such organizations as the Cement Associations, the Terra Cotta Society, the Face Brick Association, the Cut Stone Association, etc. Procedure in this way would mean large flat membership dues or a small percentage of receipts from all business handled. The contractors now do this boldly and charge it up to their customers as an item of building cost. When the contractor gets a commission, as a fee for service, it is always larger than the commission fee paid the architect for a much greater service and it is a net fee, while the Architect's fee is a gross fee out of which he must pay all of his operating expenses.

The Architect's real problem at this time is fundamentally a problem of sales. It should be faced squarely and discussed frankly. If the problem of uniform sales of professional service can be solved sanely and without jeopardy of the high professional ideals that have distinguished this calling from all others, the profession can drive on to yet greater and greater attainment. If the problem cannot be solved so as to keep the control of architecture in the hands of those who are actuated by high professional ideals, then the future of art in architecture is not promising.

INDUSTRIAL UNBALANCE

When it takes the net revenue from four to five acres of good Illinois farm land to pay a single day's wages of a building mechanic, there is something wrong with our country's economic balance, either the farmer gets too little or the mechanic gets too much. When one form of industry prospers unduly and another does not receive its just proportionate returns on capital and labor invested, then we may certainly expect a deflection of labor and also capital from the less prosperous industry to the more prosperous industry. If both industries are essential to community welfare then if one is abandoned, society must suffer. In fact society cannot safely allow any essential industry to be abandoned. Food production, farming and horticulture, is the greatest single industry in this country, second in rank is the building industry, housing, etc.; third or somewhere near along the line comes the various textile industries essential to clothing production, then follows in quick succession the fuel and transportation industries, all other industries of man are pigmy as compared with these.

Society cannot exist without them. Therefore to protect its existence, Society must insist upon the maintenance of an apportionment of labor and capital to each, so as to maintain essential balance. The cost of food and clothing has gone down to the point where it is hurting the producers to produce. In consequence, producers in these lines, both labor and capital, are cutting production and seeking occupation in other lines. The costs of building, of fuel and of transportation have constantly been advancing until they are away out of balance with food production and clothing. Why? Because, both capital and labor in the housing, fuel and transportation industries are more thoroughly organized to promote their own selfish ends at the expense of others. Meaning, also, that at the present time we are suffering from a government designed for the uniform good of the entire community which seems to be weaker than the personal selfish organizations of some of the groups over which it is supposed to rule. What is going to happen? Either, food and clothing producers are going to organize to force their just deserts or they are going to give up the fight and go into other lines. If the latter procedure is followed there will soon be no money to pay for housing, fuel and transportation and a sleeping government will be forced to draft men for food and clothing production.

The prices of moneys for building as well as for fuel and transportation are now relatively too high and the same thing may be said concerning labor. All parties concerned must realize this and lend their efforts towards peaceful, reasonable adjustment, rather than wait until the evil becomes so aggravating as to induce violent adjustment.

COMMITTEE WORK

The barometer of efficiency of activities of a Society is represented by the number and activity of its committees. The Illinois Society of Architects has employed over twenty regular standing and special Committees during the past year and while these Committees have, in some cases, met obstacles which they have been unable to completely surmount, yet they have continuously driven on, and, on the whole, have accomplished very much for the good of the profession.

It is unfair to judge committee work by a single year's endeavor, for on many of these Committees, particularly those engaged in research or legislative work, foundations have to be laid and work carried on for a number of years before satisfactory results can be finally accomplished. It may be said without undue pride that the general efficiency of the Illinois Society of Architects is probably not excelled by that of any similar local organization anywhere. Where there are numerous activities and many people engaged in them, there are always possibilities of mistakes. Only those who do nothing can escape some criticism. The Society has had its share of criticism, but needs to made no apology for the average results of its work. It is still carrying on with plans for much more effective work this year than last year. The new Entertainment Committee has demonstrated by the program of the first meeting that it has struck the key note for an effective educational program. This was one of the largest, if not the largest, regular meetings in the history of the Society.

HISTORY OF THE ILLINOIS SOCIETY OF ARCHITECTS FROM JANUARY 12, 1897, TO JANUARY 27, 1922

By George Beaumont.

This being the 25th anniversary of the Illinois Society of Architects it was deemed wise to enlighten the younger members as to how and why the Society was organized. To that end President Davidson formed a Special Historical Committee consisting of all the Past Presidents now living.

A careful search through the Archives of the Illinois Chapter of the American Institute of Architects for the years 1896 and 1897 shows that the Chicago Architects' Business Association, now the Illinois Society of Architects, had its real inception at the annual meeting of the Illinois Chapter, A. I. A., held at 4:00 P. M. on September 14th, 1896, in the Chapter rooms at 65 Washington Street, now 22 West Washington Street, then known as the Institute of Building Arts. At this meeting there were present, President Beaumont in the Chair and D. H. Perkins, Secretary; also N. S. Patton, P. B. Wight, L. G. Hallberg, W. W. Clay, S. V. Shipman, John M. Van Osdel, C. M. Palmer, Jul de Horvath, S. A. Treat, F. W. Perkins, J. C. Morrison, F. Alschlager, H. B. Wheelock, Thos. Hawkes, E. J. Ohrenstein, W. D. Cowles, S. Linderoth, W. J. Van Keuren, J. F. Doerr, J. P. Doerr and J. H. Hoskins.

These names are mentioned because they have a bearing upon the action taken at this meeting which led up to the final formation of our Society After the annual reports had been read and accepted the meeting proceeded to the election of officers for the ensuing year, the balloting resulting in the choice of L. G. Hallberg, President, J. M. Van Osdell, 1st Vice President, P. B. Wight, 2nd Vice President, H. B. Wheelock, Treasurer and D. H. Perkins, Secretary. The retiring President then escorted Mr. Hallberg to the Chair and the meeting adjourned for dinner at 6:00 P. M.

After the dinner the meeting again came to order and a general discussion took place concerning the formation of a code of ethics and the co-operation of the various bodies of contractors. It could not be decided whether an organization of this kind should be a professional club or a business body, so to bring the matter to a focus Mr. Cowles offered the following motion which carried:

Resolved, that the Chapter put itself on record as being in favor of preliminary steps being taken towards a system of organization that shall have for its object the elimination of the many evils that surround our profession that have been touched upon by previous speakers, and that the President appoint a committee of five to report a method at the next regular meeting of the Chapter. The President appointed Messrs. Treat, Patton, Cowles, Morrison and D. H. Perkins.

When this Committee made its report at the next regular Chapter Meeting on October 19th, 1896, it did not meet with the approval of the members present so was referred back to the Committee with amendments resulting from the discussion.

Evidently Mr. Cowles must have been dissatisfied with the work of the Committee or the adverse criticism upon it, as he resigned during the meeting and Wm. W. Clay was appointed to fill the vacancy. Mr. Cowles still clinging to the idea of a close business organization, called a meeting of architects which took place in the office of Cowles and Ohrenstein on the eighth floor at 115 Dearborn Street, now 25 North Dearborn Street, the exact date of which meeting is not recorded.

There were present at this preliminary meeting Messrs. Wheelock, Hawkes, Cowles, Ohrenstein, Van Osdel, Treat, Adams, Morrison, Patton, Hallberg, Cady, O. H. Postle and several others. Mr. S. A. Treat was made temporary Chairman and Mr. E. J. Ohrenstein, Secretary.

All the men present felt that an organization should be created to fill the long felt desire of the Architects to provide a logical and proper manner for conducting the business side of the profession, inasmuch as the Illinois Chapter declined or neglected to interest itself except on the esthetic side of architecture.

After a full discussion the name "Chicago Business Association" was suggested and the meeting adjourned.

The Illinois Chapter must have been informed of the rapidly growing development of this new body because, in the minutes of a meeting of the Executive Committee of the Chapter held in its rooms at the Institute of Building Arts on Nov. 23, 1896, there appears this clause: "It was moved, seconded and carried, that the Executive Committee offer the Chapter Rooms to the Architects Business Association, at all reasonable times at a compensation to be arranged by the Treasurer of this Chapter with them." There were present at this meeting, Messrs. Hallberg, Wight, Wheelock and D. H. Perkins.

As this is the first written mention of our Association, it is fair to presume that it was in an advanced formative stage between October 19, 1896 and November 23, 1896.

In the first recorded minutes of the Association, on page three it says: "A meeting of the 'Chicago Architects' was held at the Institute of Building Arts on Tuesday, January 12, 1897, for the purpose of forming an Association whose object should be the 'promotion of the business interests of the Architects of Chicago.'" There were present Messrs. J. M. Van Osdel, H. B. Wheelock, S. A. Treat, C. R. Adams, L. G. Hallberg, W. D. Cowles, F. W. Handy, E. R. Krause, N. S. Patton, J. H. Cady, J. H. Moore, R. C. Berlin, E. J. Ohrenstein, Julius H. Huber, J. C. Morrison, D. E. Postle, Jules De Horvath, W. J. Brooks and A. F. Hughes. Please note that this was not a Chapter or Illinois Society meeting, but one of Chicago architects.

H. B. Wheelock was elected Chairman and Chas. R. Adams Secretary pro tem.

It was decided "that all Architects present be entitled to vote on the question of a Constitution and By-Laws and in the election of officers, but that none, except officers and other members of the Executive Committee elected, are to be considered members of the Association, except upon application in the regular manner, and upon approval by the Executive Committee as may be laid down by the Constitution."

At this point the real birth of our Society took place, as a motion by Mr. Cady, that the Association be called "Chicago Architects Business Association" was seconded by Mr. Moore and carried. Then followed the appointment of a Committee to prepare a Constitution and By-Laws, and the election of permanent officers. The balloting shows that J. M. Van Osdel was elected President, H. B. Wheelock, First Vice President, S. A. Treat, Second Vice President, L. G. Hallberg, Treasurer, and Chas. R. Adams, Secretary. An Executive Committee was also elected consisting of W. D. Cowles, John C. Morrison, Norman S. Patton, Frank W. Handy, Julius H. Huber and Fred W. Perkins.

It was decided to hold regular monthly meetings on the second Monday in each month from September to June inclusive.

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Milwaukee Toledo Columbus Richmond Latrobe
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The Annual meeting and election of officers to be on the second Monday in March.

The rather slow accession of new members was probably due to the tendency of some of the organizers to make the Association a close corporation, and this alarmed Mr. Van Osdell so much that he resigned after serving only about three months as President, and Mr. H. B. Wheelock was elected to fill his unexpired term. The close organization and union ideas were now soon quelled and the Association properly launched on a very useful career. The membership began to increase so that by September, 1897, the rolls showed a total of seventy-six.

In the meantime the Association must have got quickly into working order, because on February 15th, 1897, we find it appealing to the Architects of Illinois to support the Chapter in its efforts to have passed by the Legislature a "Bill for the licensing and regulating the practice of Architecture as a profession." This appeal was signed by John M. Van Osdel, President, and Chas. R. Adams, Secretary.

In this connection it should be stated that Mr. Wheelock was Chairman of the Chapter Committee which had charge of the proposed license Bill, and it was largely through his splendid efforts that the Bill was introduced into the Illinois State Legislature at Springfield on January 27, 1897, by Representative Northnagel and was known as Bill No. 101. It was introduced into the Senate on February 4th, 1897, by Senator Netterstrom, when it was known as Bill No. 65. It is very pleasant to state that Representative Northnagel was a Chicago Architect who so carefully piloted the Bill through the House.

The Bill passed the House of Representatives on May 28th, 1897, it having previously passed the Senate. No amendments were made by either House, and Governor Tanner signed the Bill, June 3rd, 1897, which Bill became a law on July 1st, 1897.

Illinois was the first state to regulate, by law, the practice of Architecture.

In Mr. Wheelock's report to the Chapter he says that 1250 letters on this subject were prepared and sent out by the Committee, evolving a total expenditure of $65.36, all of which was paid by the Chapter. Evidently there was no bribery connected with the passage of this Bill.

It is with the most grateful appreciation that the Society again records the valuable assistance given by the various bodies of Building Contractors throughout the City and State when the License Bill was before the Legislature.

Soon after the Governor signed the Architects License Bill the Association decided to apply for a State Charter which was issued June 25th, 1897. The application was made by the officers and directors who stated that they wished "to promote the business interests and efficiency of the Architects of Chicago." The Charter was signed by H. B. Wheelock, S. A. Treat, L. G. Hallberg, C. W. Northnagel and C. R. Adams. The members whose names appear on the Charter are, H. B. Wheelock, President, S. A. Treat, First Vice President, C. W. Northnagel, Second Vice President, C. R. Adams, Secretary, and L. G. Hallberg, Treasurer, also Directors W. G. Barfield, D. E. Postle, J. C. Morrison, N. S. Patton, F. W. Handy and W. D. Cowles.

When the older architects saw how earnestly the Association was working and going in the right direction to serve the public they began to join, and by July 7th, 1898, the rolls showed a membership of one hundred and thirty-nine.

During the first year of the organization's existence as a corporate body it realized the necessity of publicity to further bring its aims before the architects and the public, so Mr. H. L. Palmer was engaged as Associate Editor with Mr. Adams, when the first issue of the Handbook for Architects and Builders was produced in 1898 and contained 208 pages of valuable matter which was so well received that it became a permanent yearly publication and today is known throughout the country and contains many hundreds of pages.

Mr. Palmer's work and interest in the profession was so marked that upon the death of Secretary Adams in 1905, Mr. Clay, who was then President, prevailed upon him to act as temporary Secretary until the election of Emery Stanford Hall as Secretary, by the Board of Directors.

The Society has been singularly fortunate in the selection of its Secretaries. First came Adams who served so well and faithfully until his death. Then Hall, who carried on the arduous work with a skill and liberality which gained for him the esteem of the members, and now Secretary Harris is following in the footsteps of his predecessors with a charming ability we all admire and trust.

Mr. Palmer was made Financial Secretary and today has charge of all the finances of the Society and attends to the general business of caring for the members now on the rolls. Having been very active and successful in securing new members he was asked by Mr. S. N. Crowen to call upon Mr. Davidson, who was known to be a difficult man to approach on the subject of membership, because he had gained a wrong impression of the objects of the Society. However, after considerable arguing Mr. Davidson agreed to join providing he could have something to say about its policies, which Mr. Palmer assured him would be welcome. He attended the first meeting after his election and true to his word, started a number of arguments which greatly interested those present.

How well he succeeded in endearing himself in the hearts of the members is evinced by the fact that he was elected President in 1915, 1916, 1920, 1921 and now again in 1922. This is a record which no member of the Society has achieved and much of its growth and prestige is due to his able leadership.

On one occasion Mr. Davidson filed with the Membership Committee 110 applications for membership from architects of good standing.

In 1914 the Board of Directors seeing the importance of increasing the influence of the Society throughout the State decided to change the name from the Chicago Architects Business Association to the Illinois Society of Architects, the change being ratified by a vote of the members. Soon thereafter a call was issued to call practicing architects of the State to attend a Convention which was held in the LaSalle Hotel in the fall of 1914 and again in 1915. These conventions were well attended and exerted a great influence towards cementing the fellowship of the architects throughout the State and culminated in a gratifying increase of members from many populous sections outside of Cook County.

Another important factor contributing to the success of the Society is its Monthly Bulletin, first issued in July, 1916. The Bulletin is sent monthly to each member, as a part of the service rendered by the Society to the individual. There has developed a great demand for copies of the publication from other allied interests, so that today it is circulated throughout the United States and is favorably known wherever architectural publications are read.

In looking back over the last quarter of a century we, in loving memory, deeply regret that so many of our old talented members, who fought the fight and kept the faith, have passed into the great Homeland and resting from their labors, peacefully await the glorious day of Resurrection.

THE ILLINOIS SOCIETY OF ARCHITECTS CANONS OF PROFESSIONAL ETHICS

Preamble.

The architect is engaged in a profession which carries with it grave responsibilities to the public. These duties and responsibilities cannot be met unless the motives, conduct and ability of the members of the profession are such as to command respect and confidence.

The profession of architecture calls for men of the highest integrity, and executive and artistic ability.

The architect is entrusted with financial undertakings where his honesty of purpose must be above suspicion; he acts as professional adviser to his client, and his advice must be absolutely disinterested: he is charged with the exercise of judicial functions as between client and contractor, and must act with entire impartiality, and he has moral responsibilities toward his professional associates and subordnates.

The people of the State of Illinois have a right to expect a high standard of practice and conduct on the part of the architects whom they have licensed to practice. Because an architect is a quasi public official it is imperative that he assume no obligations which shall place official duty and self-interest in conflict.

The Canons of Ethics.

No set of rules can be framed which particularize all the duties of the architect in his various relations to the public, to his client, to the building trades and to his professional brethren.

The following canons of ethics cover certain broad principles which should govern the conduct of members of the profession and should serve as a guide in circumstances other than those enumerated:

I.—On Certain Duties to the Public.

The architect's more important work is of a character so permanent and enduring that he owes it to the public to use his best efforts to make it such as may raise the standard of taste in the community and be in itself a public ornament. He should design with due regard to surroundings and should endeavor to check any individualism, whether in himself or his client, that is opposed to the public good. He should take part in those movements for public betterment in which his training and experience enable him to give useful service. He should insist on safe and sanitary construction and he should at all times hold the safe guarding of human life and health as of paramount importance to the interests of client, contractor or self.

II.—On the Architect's Status.

The architect's relation to his client is primarily that of professional advisor. This relation maintains throughout the entire period of his service. When, however, a contract is executed between his client and a builder or other person by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, a new relation is created. In respect to the matters under contract, it is incumbent upon the architect to side neither with the client nor contractor, but to endeavor, in so far as his action may determine, that the contract be faithfully carried out according to its true spirit and intent.

It is not proper for the architect to assume to act as the owner's agent unless he has been specifically empowered so to act: by so doing he becomes a party to the contract and in a sense disqualified in his judicial capacity.

The fact that the architect's payment comes through the client does not invalidate his professional obligation to act with impartiality to both parties to the contract. It is essential, however, in order to eliminate the influence of self-interest, that the architect shall not enter into any contract with the client which shall condition his payment upon his decisions or advice.

III.—On Preliminary Drawings and Estimates.

The architect should impress upon his client at the outset the importance of sufficient time for the study and preparation of drawings and specifications. If, on the basis of approved preliminary

sketches, the approximate cost of the work has been mutually considered, the architect should endeavor to bring his working drawings to meet such approximate cost, provided that his client has requested no departure from the original basis of estimate. But at the same time he should acquaint his client with the conditional character of preliminary estimates. Complete and final figures can be had only from complete and final drawings and specifications. If an unconditional limit of cost is imposed before such drawings are made and estimated, the architect must be free to make such adjustments as seem necessary to that end.

IV.—On Superintendence and Expert Service.

On all work except the simplest, it is to the interest of the client to employ an inspector or clerk-of-the-works; in many engineering problems and in certain esthetic problems such as sculpture, decorative painting, gardening and the like, it is to the interest of the client to have specialized expert service. The architect should so inform the client and assist him in obtaining such service. In order to secure unified and harmonious working organization, only such persons should be selected by the owner for consulting experts as shall work in harmony with the architect and shall be approved by him.

V.—On the Architect's Charges.

The schedule of charges of the Illinois Society of Architects is recognized as a proper minimum of payment, but where no other architect is affected it is allowable for an architect to make such an arrangement with his client as is mutually satisfactory. He may not reduce his fee below the schedule of charges in an attempt to supplant another architect; it is reasonable and proper to charge higher rates than those of the schedule when his special skill and the quality of his service justify the increase.

A system of compensation based on the actual cost to the architect on a given piece of work plus an agreed professional fee, has much to commend it.

VI.—On Needless Expenditure.

The architect should scrupulously guard cost, and refrain from introducing needless expense or any extravagance in material or construction that may add to cost of building, without compensating gain to the client.

VII.—On Payments for Expert Service.

When retained as an expert, whether in connection with competitions or otherwise, the architect should receive a compensation proportionate to the responsibility and difficulty of the service. No duty of the architect is more exacting than such service, and the honor of the profession is involved in it. Under no circumstances should experts, knowingly, name prices in competition with each other for a given employment. Where governmental regulations prohibit adequate compensation for expert service, it is better to render such service without emolument than to accept a payment out of proportion to the importance of the service rendered.

VIII.—On the Selection of Bidders or Contractors.

The architect should advise his client in the selection of bidders and in the award of contract.

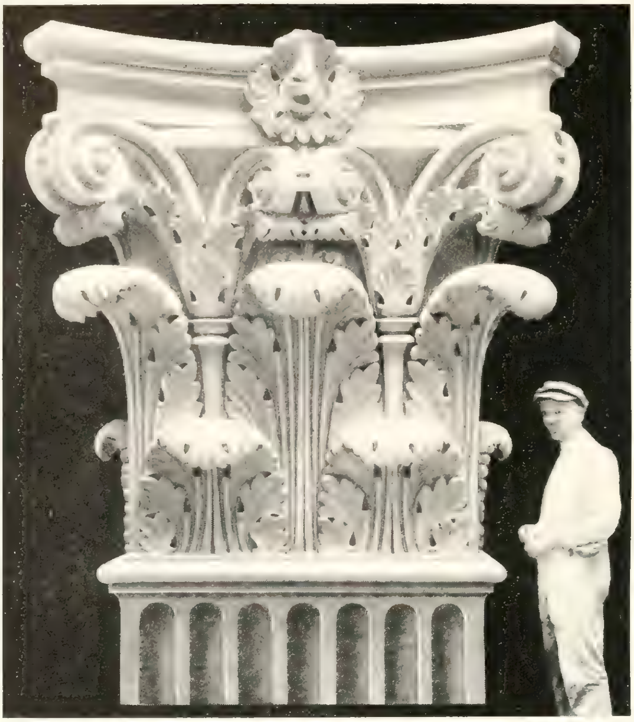
In selecting none but worthy bidders and in advising the award only to contractors who are honest and competent, the architect protects the interests of his client and helps to raise the ethical standard in building.

IX.—On Duties to the Contractor.

On the signing of a contract between owner and builder, the architect is placed in a judicial position and is bound to act with absolute fairness; he is also judge in his own right, deciding whether or not the intent of his plans or specifications is properly carried out, and exercising his judgment as to the true meaning thereof. He should, therefore, take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good his own oversights or errors, or attempt to shirk responsibility by "blanket" clauses.

X.—On Engaging in the Building Trades.

The architect should not engage in any of the building trades, nor should he form any trade partnership or agreement with any person or firm connected therewith:



Interior Furnishings Exhibit Building, Chicago
HENRY J. SCHLACKS, Architect

nor should he have any financial interests in any building material or device of such a nature as to render his professional action liable to a suspicion of self-interest: if he have any interest in building material or device, he should not specify or use the same without the full knowledge and approval of his client.

XI.—On Accepting Commission or Favors.

The architect may not receive any commission or any substantial service or favor from a dealer, a contractor, or from any interested person other than his client.

XII.—On Encouraging Good Workmanship.

In his authority to interpret and enforce the provisions of the contract, the architect is vested with large powers which he should use with unbiased judgment. While he must condemn bad work, he should also make a point of commending that which is good.

Intelligent initiative, artistic or mechanical, on the part of craftsmen and workmen, should be promptly recognized and encouraged, and the architect should make evident his appreciation of the dignity and importance of their work.

XIII.—On Offering Service Gratuitously.

The offering of professional service on approval, unless warranted by personal or previous business relations, tends to lower the dignity and standing of the profession: also to provide motive for dishonest representation and is to be condemned.

XIV.—On Advertising.

Advertising in any form is to be discouraged as tending to lower the standing of the profession. The presentation of ordinary business cards is a matter of individual taste and not per se improper; but the solicitation of work by circulars or advertisements and the inspiring or inserting of self-laudatory notice in the press are unprofessional.

The best recommendation of an architect is a well-merited reputation for professional capacity and fidelity to trust.

XV.—On Signing Buildings and Use of Titles.

The signing of buildings has the indorsement of the Chicago Architect's Business Association. The use of the initials designating degrees or technical society membership is proper in connection with any professional service and is encouraged as helping to make known the nature of the honor they imply.

XVI.—On Competitions.

In no way does the architect come more conspicuously before the public than through competitions. It is especially desirable that in such circumstances he should conduct himself with self-respect and dignity. To under value and cheapen his service or to compete where a just award is not safe guarded is inconsistent with this position. Competitions are undesirable from the standpoint of both the client and the architect and a member of of the Association should discourage the holding of same. If a competition becomes inevitible, because of governmental regulations, he should not enter either as a competitor or a professional advisor unless the competition is to be conducted according to the best practice and usage of the profession as formulated from time to time by the American Institute of Architects. Except as an authorized competitor he may not attempt to secure work for which competition has been instituted.

He may not present drawings to secure work for which competition has been closed but not decided.

He may not attempt to influence the award in any competition.

XVII.—On the Expert's Future Status.

An architect may not undertake a further commission on any building or work after having acted in an expert capacity in formulating a program which later is put into effect, or after having acted in an advisory capacity in the matter of awards in competition. Having acted in either or both of such capacities should bar an architect from eligibility to execute commissions upon the work in question.

XVIII.—On Criticising the Work of Others.

An architect may not criticise publicly in the press the work of a fellow architect except over his own signature, or editorially; and he may not intentionally injure, directly or indirectly, the reputation, prospects or business of a fellow architect.

XIX.—On Undertaking the Work of Another.

An architect may not undertake a commission while the just claim of a fellow architect, who had previously undertaken it, remains unsatisfied; nor may he attempt to supplant a fellow architect or to obtain a commission after steps have been taken toward the appointment of another architect.

XX.—On Duties Toward the Student Draughtsman.

It is the duty of the architect to advise and assist those who intend making architecture their career. The intending student should be urged to secure a preparation of broad general culture equivalent to that required for the degree of A. B., concurrently with or followed by a thorough course in a well organized school of architecture.

In cases where such preparation is out of the question and the beginner must get his training in the office of an architect, the latter should assist him to the best of

his ability by instruction and advice. An architect, should, as far as possible, urge his draughtsmen to avail themselves of educational opportunities. To this end he should give encouragement to all worthy schemes and institutions for architectural education.

Members of the society cannot too strongly insist that a thorough technical preparation for the practice of architecture should rest upon a foundation of general culture.

XXI.—On Duties Toward Building Authorities.

The architect should support all federal, state and municipal officials who have charge of matters relating to building and endeavor to maintain or improve the standards of their departments. His quasi public official capacity requires him to show respect for law by careful and conscientious compliance with all building regulations, and if any such appear to him unwise or unfair, he should endeavor to have such regulations altered, but until so altered he should comply with them. An architect because of his official relation to the state and of his moral obligation should not even under his client's instructions encourage any practices contrary to law or hostile to public interests; for he is not obliged to accept a given piece of work, hence he cannot urge in extenuation and to escape the condemnation attaching to his acts that he has but followed his client's instructions.

XXII.—On Professional Qualifications.

The assumption of the title of architect should be held to mean that the bearer has the professional knowledge, both theoretical and practical, and the natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

XXIII.—On Matters Adjudged Unprofessional.

The following code, based on a report of a special committee of the American Institute of Architects, is adopted by the Illinois Society of Architects as a general guide, yet the enumeration of particular duties should not be construed as the denial of the existence of others equally imperative though not specifically mentioned. It should also be noted that these sections indicate offenses of greatly varying degrees of gravity:

It is unprofessional for an architect—

1. To engage in any of the building trades or to form any trade partnership or agreement with any person or firm engaged therein.
2. To guarantee an estimate or contract by bond or otherwise.
3. To accept a commission or any substantial service or favor from a contractor, or anyone connected with the building trades.
4. To advertise in any form.
5. To enter any competition the terms of which are not in harmony with principles approved by the American Institute, especially if such terms have been specifically condemned by the American Institute or a local chapter thereof.
6. To attempt in any way except as a duly authorized competitor to secure work for which a competition has been instituted.
7. To attempt to influence the award of a competition.
8. To injure intentionally the fair reputation, prospects or business of another architect.
9. To criticise anonymously in the public prints, except editorially, the professional conduct or work of a fellow architect.
10. To undertake a commission while the just claim of another architect who has previously undertaken it remains unsatisfied.
11. To attempt to supplant a fellow architect after definite steps have been taken toward his employment.
12. To offer or perform services at rates lower than those approved as minimum by the Illinois Society of Architects in an attempt to supplant or underbid another architect.
13. To act in a manner detrimental to the best interests of the profession.

SCHEDULE OF PROPER MINIMUM CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS RECOMMENDED BY THE ILLINOIS SOCIETY OF ARCHITECTS

1. The architect's professional services consist of the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings, and of the general direction and supervision of the work, for which, except as hereinafter mentioned, the minimum charge is six per cent (6%), based upon the total cost of the work complete.

In case of the discontinuance or abandonment of the work, the architect's charge shall be based upon an *estimated* total cost, which estimated total cost may be determined by the architect, by experts, or by the lowest bids of responsible contractors. *Total cost* is to be interpreted as the cost of all materials and labor necessary to complete the work, plus contractors' profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered.

2. On residential work, on alterations to existing buildings, on monuments, furniture, decorative and cabinet work, and landscape architecture, it is proper to make a higher charge than above indicated.

3. The architect is entitled to compensation for articles purchased under his direction, even though not designed by him.

4. If an operation is conducted under separate contracts, rather than under a general contract, it is proper to charge a special fee in addition to the charges mentioned elsewhere in this schedule.

5. Where the architect is not otherwise retained, consultation fees for professional advice are to be paid in proportion to the importance of the questions involved and services rendered.

6. Where heating, ventilating, mechanical, structural, electrical and sanitary problems are of such a nature as to require the services of a specialist, the owner is to pay for such services in addition to the architect's regular commission. Chemical and mechanical tests and surveys, when required, are to be paid for by the owner.

7. Necessary traveling expenses are to be paid by the owner.

8. If, after a definite scheme has been approved, changes in drawings, specifications or other documents are required by the owner; or if the architect be put to extra labor or expense by the delinquency or insolvency of a contractor, the architect shall be paid for such additional services and expense.

9. The architect's entire fee is itemized and proportionate payments on account are due the architect, as the following items are completed:

Preliminary Studies	.2
General drawings	.3
Specifications	.1
Scale and full size details	.1
General Supervision of the work	.3
Total	1.00

Fee for complete services as agreed, or see paragraphs 1 and 12.

10. Items of service are comprehended as follows:

(a) **Preliminary Studies** consist of the necessary conferences, inspections, studies and sketches modified and remodified to determine the client's problem and illustrate a satisfactory general solution of same, both as to plan and elevation. Illustrative sketches for this purpose need not be to accurate scale, but should be approximately correct as to general dimensions and proportion.

(b) **General Drawings** include figured scale plans of the various stories, elevations of all the fronts, such general vertical sections as may be necessary to elucidate the design, and such details, drawn to still larger scale as, with the assistance of printed notes, and of the accompanying specifications, may make the whole scheme clearly evident to the mind of the competent builder and give him a full and complete comprehension of all the structure conditions as they affect the vital questions of quality and quantity of materials, of character of workmanship, and of cost.

(c) **Specifications** consist of a supplementary statement in words, of at least all those items of information regarding a proposed building which are not set forth in the drawings.

(d) **Detail Drawings** include all the necessary supplementary drawings required for the use of the builders, to enable them to so provide and shape their material that it may be adjusted to its proper place or function in the building with the least delay, and the smallest chance for errors and misfits. If not prepared until after the contract for the building is let they must not impose on the contractor any labor or material which is not called for by the spirit and intent of the "General Drawings" and "Specifications."

(e) The **Supervision** of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-the-works or inspector of construction) means such inspection by the architect or his deputy, of work in studios and shops or a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in general conformity with his drawings and specifications or directions. He has authority to reject any part of the work which does not so conform and to order its removal and reconstruction. He has authority to act in emergencies that may arise in the course of construction, to order necessary changes, and to define the intent and meaning of the drawings and specifications. On operations where a clerk-of-the-works or inspector of construction is required, the architect shall employ such assistance at the owner's expense.

11. Drawings and specifications, as instruments of service, are the property of the architect.

12. Exceptions.

Dwellings costing less than $10,000	10%
Lofts not requiring special planning for machinery or arrangement	5%
Additions and alterations to dwellings	12%
Additions and alterations to business buildings	10%

N. B.—Above schedule is considered minimum for ordinary and usual professional service. It is not considered fair or reasonable for highly specialized service.

LIST OF LICENSED ARCHITECTS

Members of the Profession who will be Permitted to Practice in the State of Illinois.

Every means has been used to get a correct List of Licensed Architects who are permitted to practice Architecture in the State of Illinois for the ensuing year. The names have been compared with the Official Records of the State of Illinois.

CHICAGO

Aarens, Harry B., 127 N. Dearborn St.
Abbott, Frank B., 1649-140 S. Dearborn St.
Ablamowicz, Sigmund V., 2937 N. Talman Ave.
Ahlschlager, Walter W., 65 E. Huron St.
Allen, Alfred P., 7501 N. Seeley Ave.
Allen, James Roy, 410 S. Michigan Ave.
Allison, Lyman J., 115 S. Dearborn St.
Almquist, Carl M., 118 N. La Salle St.
Alschuler, Alfred S., 28 E. Jackson Blvd.
Anderson, Edwin F., 2015 Howe St.
Anderson, Helge A., 3116 Sunnyside Ave.
Anderson, Pierce, 80 E. Jackson Blvd.
Anderson, William C., 5431 Harper Ave.
Andresén, Theodore, 643 Barry Ave.
Angell, Arnold A., 825 Cornelia Ave.
Anis, Albert, 127 N. Dearborn St.
Ansel, Anton, 5047 Cullom Ave.
Apfelbach, Henry J., 2133 Fremont St.
Archer, Chas. S., 6849 Dorchester Ave.
Armstrong, John A., 127 N. Dearborn St.
Aroner, Jacob S., 25 E. Jackson Blvd.
Ashby, George William, 1511 W. Jackson Blvd.
Ashby, Wilbert B., 1511 W. Jackson Blvd.
Bacon, James Earl, 7332 Phillips Ave.
Bailey, Cyrus, 9 S. Clinton St.
Bannister, George S., 115 S. Dearborn St.
Barfield, William G., 58 W. Washington St.
Bargman, Ewald F., 1408 Jarvis Ave.
Barnes, Allen L., 1329 Birchwood Ave.
Barrett, Fred L., 4411 N. Kedzie Ave.
Barthel, Bernard, 127 N. Dearborn St.
Barton, F. M., 3426 S. Kedzie Ave.
Baumeister, George E., 201 E. 70th St.
Bean, Ralph H., 825-111 W. Monroe St.
Beaudry, Ralph L., 7047 Princeton Ave.
Beck, H. Frederic, 159 Ontario St.
Beck, Willis J., 722-118 N. La Salle St.
Beers, Herbert P., 53 W. Jackson Blvd.
Behrns, Elmer F., 3429 N. Troy St.
Beiler, Henry P., 1924 Waveland Ave.
Bein, Maurice L., 139 N. Clark St.
Bellas, Charles, 721 Barry Ave.
Beman, Spencer S., 108 S. La Salle St.
Bendus, William Quincy, 64 E. Van Buren St.
Bennett, A. J. T., 38 S. Dearborn St.
Bennett, Edward H., 1800-80 E. Jackson Blvd.
Bennett, Wm. Arthur, 117 N. Dearborn St.
Benson, Arthur E., 5412 N. Clark St.
Benson, Edward, 5412 N. Clark St.
Bentley, Harry H., 1124 Monroe Bldg.
Berlin, Robert C., 19 S. La Salle St.
Bernham, Felix M., 1213 E. 65th St.
Bernhard, Wilhelm, 138 N. La Salle St.
Betts, Wm. B., 155 N. Clark St.
Bialles, Theo. P., 3759 N. Kedvale Ave.
Bicknell, Alfred H., 3801 N. Hoyne Ave.
Bischof, Jacob H., 2635 Hampden Court.
Bishop, Thomas R., 35 S. Dearborn St.
Bjork, David T., 5240 N. Sawyer Ave.
Blondin, Edward A., 5 W. Garfield Blvd.
Blouke, Pierce, 1217 Astor St.
Bodholdt, Arne, 1601-104 S. Michigan Ave.
Bollenbacher, J. C., 108 S. La Salle St.
Booth, Herbert L., 7431 Kenwood Ave.
Bouchard, Lewis C., 30 N. Dearborn St.
Bourke, Robt. E., 10440 S. Seeley Ave.
Bowen, Howard, 549 W. Washington St.
Bowes, Frederick Wm., 552 N. Pine Ave.
Braband, Frank J. E., 549 W. Washington St.
Brabant, Gifford, 2717 N. Kedzie Ave.
Brand, Herbert A., 111 W. Washington St.
Brandner, Louis T., 1432 Berteau Ave.
Brandt, Berkeley, 30 N. Michigan Ave.
Branitzky, Wm. Thomas, 64 W. Randolph St.
Braucher, Ernest N., 6 N. Clark St.
Braun, Isadore H., 19 S. La Salle St.
Braun, Wm. T., 64 E. Van Buren St.
Bright, Jasper T., 1507-139 N. Clark St.
Bristle, Joseph H., 108 S. La Salle St.
Britton, Frank, 817 W. 70th St.
Brown, Arthur Geo., 109 N. Dearborn St.
Bruns, Benedict J., 1548 Belmont Ave.
Brydges, E. Norman, 64 E. Van Buren St.
Buck, Lawrence, 64 E. Van Buren St.
Buck, Niels, 3123 N. Clark St.
Buckett, Arthur C., 155 N. Clark St.
Buerger, A. J., Jr., 547 N. Leamington Ave.
Bullock, Edwin C. A., 190 N. State St.
Burgess, Ralph R., 1830 Calumet Ave.
Burnham, Daniel H., Jr., 209 S. La Salle St.
Burnham, Hubert, 209 S. La Salle St.
Burns, James, 64 W. Randolph St.
Burt, Henry J., 1400-104 S. Michigan Ave.
Byerly, Fred I., 11131 S. Irving Ave.
Byrne, Francis B., Irving Park Blvd & Lake.
Cable, Max Lowell, 415 N. Western Ave.
Cady, J. K., 179 W. Washington St.
Caldwell, Will C., 1226-19 S. La Salle St.
Camp, Ervin M., 4415 Malden St.
Capraro, Alexander V., 64 W. Randolph St.
Carey, James L., 208 N. Laramie Ave.
Carlson, Richard J., 915 Fletcher St.
Carnegie, Wm. G., 189 W. Madison St.
Carpenter, Martin R., 72 W. Washington St.
Carr, George Wallace, 122 S. Michigan Ave.
Cenek, Robert R., 118 N. La Salle St.
Cerny, Jerry J., 1444 S. Crawford Ave.
Charles, Walter E., 913-155 N. Clark St.
Charvat, Anton, 2621 Millard Ave.
Chase, Frank D., 645 N. Michigan Ave.
Chatten, Melville C., 64 E. Van Buren St.

Cheney, Howard Lovewell, 208 S. La Salle St.
Childs, Frank A., 64 E. Van Buren St.
Christenson, C. Werner, 1818 Greenleaf Ave.
Christensen, Hans C., 7258 Union Ave.
Christensen, John C., 3255 Evergreen Ave.
Christiansen, Eli, 7047 Indiana Ave.
Christie L. R., 2010 W. Van Buren St.
Chubb, John D., 109 N. Dearborn St.
Church, Walter S., 157 W. Division St.
Clark, Edwin H., 8 E. Huron St.
Clark, Leslie Doane, 6233 Greenwood Ave.
Clark, Robert C., 7216 Harvard Ave.
Clay, William W., 538 S. Dearborn St.
Cobb, Wm. H., 2156 Sunnyside Ave.
Coffin, Arthur S., 39 W. Adams St.
Cohen, Isadore, 442 E. 48th St.
Cohen, Joseph, 758 S. Kilbourne Ave.
Colcord, Albert E., 6143 St. Lawrence Ave.
Cole, Arthur W., 5413 Greenwood Ave.
Comm, Benjamin A., 3227 W. Division St.
Conrad, George E., 585 Isham St.
Cook, Norman W., 1283 Victor Ave.
Coolidge, Chas. A., 134 S. La Salle St.
Coughlen, Gardner C., 19 S. La Salle St.
Crane, Charles Howard, 127 N. Dearborn St.
Crosby, Wm. S., 179 W. Washington St.
Crowen, Samuel N., 10 S. La Salle St.
Dalsey, H. I., 2321 W. North Ave.
Davey, John Jeffrey, 1407 Manhattan Bldg.
Davidson, Frank E., 53 W. Jackson Blvd.
Davis, Zachary T., 400 N. Michigan Ave.
Dean, Arthur R., 137 S. La Salle St.
De Golyer, Robt. S., 7 S. Dearborn St.
Del Campo, Scipione, 829 Marshfield Ave.
De Money, Frank O., 5 N. La Salle St.
Denell, Reuben A., 2248 Lunt Ave.
Dennis, Charles A., 4031 Patterson Ave.
Denson, James F., 5 N. La Salle St.
Dewey, Charles, 4842 Winthrop Ave.
Dibelka, James B., 2743 W. 22nd St.
Dillard, Frank G., 1449 Granville Ave.
Dinkelberg, Fred'k P., 400 N. Michigan Ave.
Dippold, Albert P., 4747 Cottage Grove Ave.
Doerr, Harold F., 105 N. Clark St.
Doerr, Jacob F., 105 N. Clark St.
Doerr, Wm. P., 28 E. Jackson Blvd.
Doerr, Wm. Phillip, Jr., 105 N. Clark St.
Dougherty, Floyd E., 35 N. Dearborn St.
Dowling, Edward F., 640 N. Michigan Ave.
Downton, Herbert E., 1340 N. Central Ave.
Dubin, George H., 14 W. Washington St.
Dubin, Henry, 14 W. Washington St.
Duckworth, John S., 20 W. Jackson Blvd.
Dunford, S. H., 38 S. Dearborn St.
Dunlap, Francis E., 81 E. Madison St.
Dunning, N. Max, 310 S. Wabash Ave.
Durkee, Arthur R., 6359 S. Peoria St.
Dvorak, Jos., 3219 W. 22nd St.
Dwen, Robert G., 8 E. Huron St.
Dyer, Scott C., 38 S. Dearborn St.
Eckstorm, Christian A., 5 N. La Salle St.
Eich, George B., 39 S. State St.
Eichberg, S. Milton, 64 W. Randolph St.
Ehmann, Wm. Frederick, 140 S. Dearborn St.
Ellert, Frank J., 56 E. Randolph St.
Elmslie, Geo. C., 122 S. Michigan Ave.
Erickson, Allan E., 105 W. Monroe St.
Erickson, Carl A., 104 S. Michigan Ave.
Ermeling, Ralph W., 64 E. Van Buren St.
Eskridge, Fred A., 6654 Stewart Ave.
Esser, Curt A., 38 S. Dearborn St.
Esser, Paul F., 1304 Hood Ave.
Fairclough, Stanley D., 811 Exchange Ave., U. S. Yards.
Falls, Alexander S., 4408 Oakenwald Ave.
Farrier, Clarence W., 1142 S. Michigan Ave.
Faulkner, Chas. D., 140 S. Dearborn St.
Fellows, Wm. K., 814 Tower Court.
Ferree, Harold C., 57 E. Jackson Blvd.
Ferrenz, Tirrell John, 645 N. Michigan Ave.
Fielder, Fred A., 2721 S. Michigan Ave.
Filas, Thos. M., 15 E. Van Buren St.
Finck, Sidney C., 1215 W. Madison St.
Fischer, F. Wm., 9129 Commercial Ave.
Fischer, John B., 140 S. Dearborn St.
Fisher, Albert J., 2001 Greenleaf Ave.
Fisher, Joseph G., 2005 Greenleaf Ave.
Fishman, M. Maurice, 118 N. La Salle St.
Flaks, Francis A., 1956 S. Springfield Ave.
Flesch, Eugene P., 5115 University Ave.
Fletcher, Robert C., 179 W. Washington St.
Flinn, Raymond W., 1412-8 S. Dearborn St.
Flizikowski, John S., 3615 N. Harding Ave.
Floto, Julius, 53 W. Jackson Blvd.
Foehringer, Frederick, 2672 Orchard St.
Fogel, R. W., 1839 Warner Ave.
Foltz, Frederick C., 111 W. Washington St.
Fortin, Joseph T., 600 Blue Island Ave.
Foster, Arthur, 56 E. Randolph St.
Foster Winslow H., 9238 Pleasant Ave.
Fournier, Lawrence A., 5417 Dorchester Ave.
Fowler, Frank E., 750-332 S. Michigan Ave.
Fox, Charles E., 721 S Michigan Ave
Fox, Elmer J., 9209 University Ave.
Fox, John J., 38 S. Dearborn St.
Fox, William Paul, 38 S. Dearborn St.
Foy, Wm. D., 1400-104 S. Michigan Ave.
France, Roy F., 155 N. Clark St.
Francisco, Ferris Le Roy, 39 S. La Salle St.
Franklin, Robert L., 64 E. Van Buren St.
Franzheim, H. Kenneth, 127 N. Dearborn St.
Frazier, Clarence E., 30 N. Dearborn St.
Friedl, Herman, 154 W. Randolph St.
Friedman, Raphael N., 5436 Ellis Ave.
Frodin, Rube S., 808-30 N. Michigan Ave.
Frommann, Emil H., 64 W. Randolph St.
Frost, Charles S., 105 S. La Salle St.
Frost, Harry Talfourd, 1800 Railway Exch.
Fry, Frank L., 140 S. Dearborn St.
Fugard, John Reed, 212 E. Superior St.
Fullenwider, Arthur E., 640 N. Michigan Ave.
Fuller, Alex. A., 189 W. Madison St.
Fuller, Ravilo Franklyn, 6 N. Michigan Ave.
Furst, Wm. H., 140 S. Dearborn St.
Garden, Hugh M. G., 104 S. Michigan Ave.
Gardner, Horace C., 140 S. Dearborn St.
Garnsey, Geo. O., 1817 Washington Blvd.
Gassmann, Andrew P., 143 N. Lorel Ave.
Gatterdam, Fred E., 154 W. Randolph St.
Gauger, Wm., 36 W. Randolph St.
Gaul, Hermann, 111 W. Washington St.
Gerber, Arthur U., 20 W. Jackson Blvd.
Gerhardt, Paul, 64 W. Randolph St.
Gibb, William R., 117 N. Dearborn St.
Gibbs, Archibald D. (no address).
Gibson, Bayard K., 608 S. Dearborn St.
Goodman, Wm. C., 2932 W. Adams St.

Gormley, Jas. R., 3555 Ainslee St.
Graham, Ernest R., 80 E. Jackson Blvd.
Granger, Alfred H., 619 N. Michigan Ave.
Graven, Auker S., 917 Windsor Ave.
Green, Herbert H., 308 S. Wabash Ave.
Greenfield, Geo. H., 6023 Kenwood Ave.
Greengard, Bernhard C., 619 N. Michigan Ave.
Gregori, Raymond, 155 N. Clark St.
Griesser, Richard, 64 W. Randolph St.
Griffin, Walter B. (no address).
Griser, Keith L., 2109 Leland Ave.
Grotz, Chas. J., 3514 Wrightwood Ave.
Gubbins, Wm. F., 4059 W. Monroe St.
Guenzel, Louis, 111 W. Washington St.
Gurnee, Daniel S., 1426 E. 67th Pl.
Gustafson, Carl A., 1021 Ainslee St.
Haagen, Paul T., 155 N. Clark St.
Hagerup, Leonard O., 1462 Carmen Ave.
Hall, Alfred G. (no address).
Hall, E. Stanford, 64 E. Van Buren St.
Hall, Eric E., 123 W. Madison St.
Hall, Lincoln N., 5251 Winthrop Ave.
Hallberg, L. G., 116 S. Michigan Ave.
Halperin, Casriel, 19 S. La Salle St.
Hamilton, John L., 814 Tower Court.
Hammond, Charles H., 64 E. Van Buren.
Hancox, Charles J. (no address).
Hanna, John Paul, 111 W. Washington St., c/o Sinclair Refining Co.
Hanselmann, Herman, 57 W. Delaware Pl.
Hansen, Christian O., 1037 N. Dearborn St.
Hansen, Gunnard A., 7915 Evans Ave.
Hansen, Paul, 830 Lawrence Ave.
Happell, Otto Gottlieb, 568 Arlington Pl.
Harley, William H., Jr., 117 N. Dearborn St.
Harris, Mandel H., 118 N. La Salle St.
Harris, Ralph C., 190 N. State St.
Hartigan, W. B., 22 S. Albany Ave.
Harvey, George L., 105 S. Dearborn St.
Hatzfeld, Clarence, 7 S. Dearborn St.
Hauber, Carl, 10 S. La Salle St.
Hawk, A. T., 714 La Salle St., R. R. Station.
Hawkinson, Carl W., 108 S. La Salle St.
Hecht, Albert S., 155 N. Clark St.
Heda, Arthur M., 3229 W. Division St.
Hegsted, Martin A., 3725 Belden Ave.
Heimbeck, Walter C., 1736 W. 102nd St.
Heinz, Lorenz H., 128 N. La Salle St.
Henderson, Charles C., 105 S. La Salle St.
Henschien, H. Peter, 1637 Prairie Ave.
Herter, John T., 4738 Woodlawn Ave.
Hetherington, John T., 105 N. Clark St.
Hetherington, Murray D., 105 N. Clark St.
Hettinger, John P., 4708 Dover St.
Heun, Arthur, 64 E. Van Buren St.
Hild, Edward G., 232 E. Erie St.
Himelblau, A. L., 179 W. Washington St.
Hine, Cicero, 3221 Broadway.
Hirschfield, Leo S., 64 W. Randolph St.
Hocke, John, 836 64th Pl.
Hodgdon, Charles, 134 S. La Salle St.
Hodgdon, Frederick M., 1409 Greenleaf.
Hoffman, Wm. L., Jr., 144 W. 47th St.
Hogenson, Edward A., 5818 Magnolia Ave.
Holabird, John Augur, 104 S. Michigan Ave.
Holabird, Wm., 104 S. Michigan Ave.
Holmboe, Leonard C. B., 2034 E. 72nd St.
Holmes, Harold, 151 E. Chicago Ave.
Holmes, Morris G., 8 S. Dearborn St.
Holsman, Henry K., 310 S. Wabash Ave.
Hooper, Wm., 201 E. Ontario St.
Horwich, Louis J., 6150 Greenview Ave.
Hoskins, John M., 2837 W. Madison St.
Hotton, B. J., 1113 Drummond Pl.
Hubbard, Bert Charles, 225 N. Michigan Ave
Huber, Julius H., 2039 Greenleaf Ave.
Hughes, Andrew F., 7012 Eggleston Ave.
Hulla, John, 140 S. Dearborn St.
Hunt, Jarvis, 30 N. Michigan Ave.
Hussander, Arthur F., 25 N. Dearborn St.
Huston, Sanford K., Jr., 5468 Woodlawn
Huszaph, Ralph D., 6256 Winthrop Ave
Hyde, Robert M., 8 S. Dearborn St.
Hyland, Paul V., 159 E. Ontario St.
Ingalls, Arthur R., 7207 Yale Ave.
Ingram, Horace, 5718 Kenwood Ave.
Isensee, Frederic M., 6417 Minerva Ave.
Jacobs, Arthur, 138 N. La Salle St.
Jeckel, Philip F., 569 Arlington St.
Jenkins, A. D., 6 N. Michigan Ave.
Jensen, Clarence A., 310 S. Wabash Ave.
Jensen, Elmer C., 39 S. La Salle St.
Jensen, Jens J., 4815 N. Lawndale Ave.
Jillson, B. H., 190 N. State St.
Jobson, C. Frank, 225 N. Michigan Ave.
Johnck, Frederick, 140 S. Dearborn St.
Johnson, Benj. L., 38 S. Dearborn St.
Johnson, Carl J., 5124 N. St. Louis Ave.
Johnson, Oscar, 4770 N. Lincoln Ave.
Johnson, Robert U, 6809 N. Hillsdale Ave.
Johnston, William K., 6805 Yale Ave.
Johnstone, Percy T., 1254 Pratt Blvd.
Jones, Wm. C., 19 S. La Salle St.
Joy, Samuel Scott, 2001 W. 39th St.
Kallal, Chas. W., City Hall.
Kallenbach, Henry, Jr., 3428 N. Hamilton Ave.
Kane, Robert L., 6643 Stewart Ave.
Kilroy, John G., 4800 Calumet Ave.
Kingsley, George S., 109 N. Dearborn St.
Kirkpatrick, Robert A., 3967 Lake Park Ave.
Klafter, David Saul, 64 W. Randolph St.
Klafter, Joseph H., 127 N. Dearborn St.
Klamt, Edward A., 713 Wrightwood Ave.
Klein, Wm. J., 111 W. Washington St.
Klewer, Arthur, 1112 Columbia Ave.
Klewer, Geo. W., 7016 Sheridan Road.
Knapp, George Arnold, 212 E. Superior St.
Knox, Arthur H., 7 W. Madison St.
Knudsen, Johan F., 5247 Calhoun Ave.
Kocher, Jacques J., 6250 S. Halsted St.
Koenig, Fred, 2252 Clifton Ave.
Koenigsberg, Nathan, 5 N. La Salle St.
Kohfeldt, Walter G., 400 N. Michigan Ave.
Koll, Henry C., 2155 Elston Ave.
Koster, John L., 1314 E. 55th St.
Kramer, William F., 400 N. Michigan Ave.
Krause, Edmund R., c/o The Drake Hotel.
Krieg, Wm. G., 105 N. Clark St.
Kuehne, Carl Oskar, 1572 N. Halsted St.
Kupfer, Otto A., 1865 Millard Ave.
Kurzon Bernard R., 64 W. Randolph St.
Lagergren, Gustav P., 1125 W. 79th St.
Laist, Theodore F., 111 W. Monroe St.
Lampe, Clarence W., 155 N. Clark St.
Land, Herbert Henry, 5410 Cortez Ave.

Lane, Harry L., 1923 Calumet Ave.
Lang, Albert, 7 W. Madison St.
Langille, Louis E., 1657 Juneway Tr.
Larmon, Philip, 6533 Kimbark Ave.
Lautz, William H., 64 E. Van Buren St.
Lawrence, Albin, 123 W. Madison St.
Layer, Robert, 19 S. La Salle St.
Leavell, John C., 6606 University Ave
Ledebuhr, Arthur E., 6447 Rhodes Ave.
Lehle, Louis, 3810 Broadway.
Lenske, Charles H., 3755 Irving Park Blvd.
Leviton, Morton, 53 W. Jackson Blvd.
Levy, Alexander L., 111 W. Washington St.
Lewin, Edw. P., 919 S. Irving Ave.
Lewis, Jacob, 64 W. Randolph St.
Lewis, Le Roy, Jr., 104 S. Michigan Ave.
Liedberg, Hugo J., 154 W. Randolph St.
Lindblad, Alfred G., 824 Aldine Ave.
Lindquist, Frederick, 179 W. Washington.
Lindquist, Joseph B., 4534 Drexel Blvd.
Lindstrand, John A., 1661 N. Oakley Ave.
Lindstrom, R. S., 15 E. Van Buren St.
Liska, Adolph C., 212 E. Superior St.
Liska, Charles O., 4338 W. 22nd St.
Liska, Emil, 9601 Prospect Ave.
Llewellyn, Joseph C., 38 S. Dearborn St.
Llewellyn, Ralph C., 38 S. Dearborn St.
Lloyd, Albert L., c/o Pond & Pond, 64 E. Van Buren St.
Loewenberg, Israel S., 111 W. Monroe St.
Long, Frank B., 1400-104 S. Michigan Ave.
Lonek, Adolph, 1867 S. Avers Ave.
Lorenc, Joseph A., 6712 Imlay St.
Lovdall, Geo. F., 25 N. Dearborn St.
Lovell, Sidney, 30 N. Michigan Ave.
Lovell, McDonald, 30 N. Michigan Ave.
Lowe, Elmo C., 108 S. La Salle St.
Ludgin, J. G., 53 W. Jackson Blvd.
Luebkert, Otto, 643 Wellington Ave.
Lund, Anders G., 453 W. 63rd St.
Lurvey, Louis, 721 S. Western Ave.
MacBride, E. Everett, 64 E. Van Buren St.
Mahaffey, David, 118 N. La Salle St.
Maher, George W., 157 E. Erie St.
Maher, Philip Brooks, 157 E. Erie St.
Maiwurm, Arthur B., 130-82 W. Washington St.
Marley, Joseph J., 2959 W. 39th St.
Mallinger, John, 3626 N. Racine Ave.
Manierre, Alfred E., 112 W. Adams St.
Mann, William D., 155 N. Clark St.
Marienthal, Oscar B., 65 E. Huron St.
Marshall, Benj. H., 721 N. Michigan Ave.
Martin, Edgar D., 104 S. Michigan Ave.
Martin, Edwin D., 5 N. La Salle St.
Martini, Elisabeth A., 155 N. Clark St.
Marx, Sam'l A., 1336 W. Washington Blvd.
Masters, Geo. A., 3645 Maple Square.
Math, Earle R., 357 E. 56th St.
Matteson, Victor Andree, 8 S. Dearborn St.
Maurer, Wm., 2426 Augusta St.
Mayer, Carl H., 1447 Balmoral Ave.
Mayger, Arthur G., 1510 E. 52nd St.
Mayo, Ernest A., 53 W. Jackson Blvd.
McArthur, Albert Chase, 39 W. Adams St.
McCarthy, Charles A., 5174 Indiana Ave.
McCarthy, Jos. W., 139 N. Clark St.
McClellan, Edward G., 7441 Cottage Grove
McDonald, Luther Wilson, 849 E. 73rd St.
McDougall, Walter A., 4333 St. Lawrence Ave.
McGavick, J. P., 1036 E. 46th St.
McGrath, Paul J., 845 Lakeside Pl.
McGrew, Kenneth A., 3847 N. Tripp Ave.
McLane, Cyrus D., 127 N. Dearborn St.
McLaren, Robert J., 1637 Prairie Ave.
McLaughlin, Daniel F., 2118 E. 73rd St.
McMurry, Oscar L., 10405 S. Seeley Ave.
Meldahl, Jens J., 104 S. Michigan Ave.
Meles, Edmund J., 431 S. Dearborn St.
Meredith, Davis D., 4819 N. Albany Ave.
Merrill, John O., 108 S. La Salle St.
Meyer, Frederic H., 30 N. Dearborn St.
Michaelsen, C. S., 3815 W. Congress St.
Miller, Grant C., 640 N. Michigan Ave.
Miller, H. Clyde, 112 W. Adams St.
Miller, John W., 2001 W. Van Buren St.
Miller, Jos. A., 155 N. Clark St.
Miller, Lee, 4337 Calumet Ave.
Miller, Marcus P. (no address).
Miller, Walter F., 50 E. Walton Pl.
Miller, Wm. C., 204 N. Karlov Ave.
Milman, Ralph E., 108 S. La Salle St.
Minchen, Sidney H., 19 W. Jackson Blvd.
Minkus, Robert L., 1505 W. Austin Ave.
Mitchell, Lewis M., 138 N. La Salle St.
Mohr, Frederick J., 721 N. Michigan Ave.
Morehouse, Merritt J., 343 S. Dearborn St.
Morey, Arthur G., 6101 N. Clark St.
Morgan, Charles L., 104 S. Michigan Ave.
Morrison, James R. M., 64 W. Randolph St.
Morphett, Archibald S., 6016 Stoney Island Ave.
Morrow, Archibald Wm., 64 W. Randolph St.
Morse, Harry Leon, 1439 Ardmore Ave.
Mosher, E. Bradford, 5830 Harper Ave.
Mozier, Harry P., 59 E. Madison St.
Mrazek, Joseph M., 1239 S. Tripp Ave.
Mueller, Carl Oscar, 752 Buena Ave.
Mueller, Herbert E., 3752 Rokeby St.
Mulder, Herman A., 1713-140 S. Dearborn St.
Mullay, Thomas H., 179 W. Washington St.
Mundie, Wm. Bryce, 39 S. La Salle St.
Nadherny, Joseph J., 38 S. Dearborn St.
Nathan, Myer O., 123 W. Madison St.
Neebe, John, 2522 Aubert Ave.
Nelson, Edward O., 232 E. Erie St.
Nelson, Melvin A., 2612 Eastwood Ave.
Nettenstrom, Joel W., 2425 Canton St.
New, Matthew, 2514 E. 91st St.
Newberry, Robert T., Hotel Ambassador.
Newbold, Roy E., 2457 Sunnyside Ave.
Newhouse, Henry L., 4630 Prairie Ave.
Newman, Edgar M., 107 N. Clark St.
Nicholson, Jos. T., 7514 Chappel Ave.
Nicholson, Wm. A., 6437 Harvard Ave.
Nielsen, C., 1853 Greenleaf Ave.
Nielsen, Elker Rosehill, 3059 Augusta St.
Niemz, Arthur R., 847 Bradley Pl.
Nimmons, George C., 122 S. Michigan Ave.
Nitsche, Edward A., 1340 Farwell Ave.
Norman, A. E., 4750 Sheridan Road.
Novy, Jos. J., 2434 Ridgeway Ave.
Nyden, John A., 190 N. State St.
Odgers, Phillip, 5913 E. Circle Ave.
Ohrenstein, Ernest J., 232 E. Erie St.
Oldefest, Edw. G., 122 S. Michigan Ave.

Oliver, Ralph H., 115 S. Dearborn St.
Olsen, Leif E., 1615-155 N. Clark St.
Olsen, Paul F., 127 N. Dearborn St.
Olson, Benj. Franklin, 19 S. La Salle St.
Ording, Carl Henry, 1923 Calumet Ave.
Ostergren, Robert C., 155 N. Clark St.
Otis, Samuel Shockford, 6 N. Michigan Ave.
Otis, Wm. A., 6 N. Michigan Ave.
Packard, Allyn A., 7609 Eastlake Terrace.
Pagels, Wm. F., 1128 Argyle Ave.
Park, John W., 817 N. Dearborn St.
Parsons, Wm. Edward, 80 E. Jackson Blvd.
Pashley, Alfred F., 431 S. Dearborn St.
Patelski, Erich J., 2550 W. Jackson Blvd.
Pearson, Gustav E., 1930 N. Keystone Ave.
Perkins, Dwight Heald, 814 Tower Court.
Perkins, Frank W., 8133 S. Sangamon St.
Perry, Walter E., 212 E. Superior St.
Peterson, Stanley M., 4216 N. Hermitage Ave.
Pierce, Richard Gordon, 10 S. La Salle St.
Pingrey, Roy E., 209 S. La Salle St.
Piontek, Clement L., 2952 Milwaukee Ave.
Pischel, Frederick, 4017 Milwaukee Ave.
Pistorius, Bernard H., 700 Melrose St.
Pleins, Leo H., 544 S. Franklin St.
Pomeroy, Jim T., 608 S. Dearborn St.
Pond, Allen Bartlit, 64 E. Van Buren St.
Pond, Irving K., 64 E. Van Buren St.
Pope, John Francis, 2944 Lexington St.
Popkin, J. L., 115 S. Dearborn St.
Poulsen, Edward J., 4019 N. Harding Ave.
Poulsen, George F., 1374-208 S. La Salle St.
Powers, Horace S., 5 N. La Salle St.
Prather, Fred V., 400 N. Michigan Ave.
Presto, Wm C., 111 W. Washington St.
Pridmore, John E. O., 38 S. Dearborn St.
Prindeville, Chas H., 58 E. Washington St.
Probst, Edward, 80 E. Jackson Blvd.
Proskauer, Adolph, 127 N. Dearborn St.
Pruyn, Wm. H., 122 S. Michigan Ave.
Puckey, F. W., 6 N. Michigan Ave.
Pugh, Myron E., 2915 Jackson Blvd.
Quackenboss, L. G., 6616 Glenwood Ave.
Quinn, James Edwin, 10 S. La Salle St.
Quitsow, Anthony H., 1036 Dakin St.
Rabig, Charles E., Klari, 1321 E. 64th St.
Raeder, Henry, 20 W. Jackson Blvd.
Rapp, C. W., 190 N. State St.
Rapp, Geo. L., 190 N. State St.
Rappaport, Benjamin J., 6709 Lakewood Ave.
Ratcliffe, H. E., 4633 N. Robey St.
Rawson, Chas P., 839 Diversey Pkwy.
Rawson, Lorin A., care C. H. Strong & Co., 180 N. Market St.
Rebori, A. N., 332 S. Michigan Ave.
Reed, Earl Howell, Jr., 108 N. Dearborn St.
Reilly, S. L., 112 W. Adams St.
Renwick, Edward A., 104 S. Michigan Ave.
Repp, George W., 1743 W. 100th Pl.
Rezny, James B., 2202 S. Crawford Ave.
Rice, Josiah L., 4213 N. Ashland Ave.
Rich, Evert, 10420 Prospect Ave.
Richards, H. H., 5467 Washington Blvd.
Riddle, Herbert H., 122 S. Michigan Ave.
Riddle, Lewis W., 122 S. Michigan Ave.
Rinn, Charles, 3041 Leland Ave.
Rippel, Fred O., 140 S. Dearborn St.
Rissman, Maurice B., 64 W. Randolph St.
Ritter, Louis E., 1707 Marquette Bldg.
Roberts, Eben E., 82 W. Washington St.
Robertson, D., 8 S. Dearborn St.
Robinson, Argyle E., 5227 Harper Ave.
Robinson, Harry F., 137 S. La Salle St.
Roche, Martin, 104 S. Michigan Ave.
Roeddiger, F. W. C., 4936 Champlain Ave.
Rognstad, Sigurd A., 3815 W. Congress St.
Rohm, Jean Baptist, 138 N. La Salle St.
Rohm, Wm., 138 N. La Salle St.
Roller, Herman D., 64 E. Van Buren St.
Root, John Wellborn, 104 S. Michigan Ave.
Ross, Henry, 6741 Sheridan Road.
Roth, Edgar, 7550 Saginaw Ave.
Rother, Eugene Paul, 2507 N. Cullom Ave.
Rouleau, Arthur, 4004 W. Van Buren St.
Rowe, Charles Barr, 127 N. Dearborn St.
Rowe, Lindley P., 127 N. Dearborn St.
Roy, Franz, 7817 S. Shore Drive.
Runde, Otto, 4831 Barry Ave.
Rupert, Edward P., 19 S. La Salle St.
Ruttenberg, Albert, 64 W. Randolph St.
Russell, Lewis E., 25 N. Dearborn St.
Rusy, Anthony F., 1339 S. Avers Ave.
Ryan, J. William, 154 W. Randolph St.
Sailor, Homer G., 417 W. 61st St.
Salisbury, Robert H., 118 N. La Salle St.
Sandegren, Andrew R., 116 E. Oak St.
Sandel, Monroe R., 4830 N. Ridgeway Ave.
Sanders, Lewis Miles, 3311 Wrightwood Ave.
Saxe, Albert Moore, 64 E. Van Buren St.
Saxe, Ira C., 351 Belden Ave.
Schaffner, Daniel J., 139 N. Clark St.
Schaub, Louis J., 3305 Wrightwood Ave.
Scheller, Jesse E., 7606 Crandon Ave.
Schenck, Rudolph, 122 S. Michigan Ave.
Schimek, Alfred F., 1420 S. Ashland Ave.
Schlacks, Henry John, 721 N. Michigan.
Schmalz, Emil C., 5041 W. Madison St.
Schmid, Richard G., 154 W. Randolph St.
Schmidt, Hugo, 1165 N. Clark St.
Schmidt, Richard Ernest, 104 S. Michigan.
Schnakenberg, Henry, 3238 Wilson Ave.
Schneberger, John G., 2320 S. Trumbull Ave.
Schock, Frederick R., 5804 Midway Park.
Schoening, John A., 43 W. 33d St.
Schreiber, Geo. F., 105 W. Monroe St.
Schultz, Martin M., 1955 W. 20th St.
Schulze, Carl Elliott, 1511 W. Jackson Blvd.
Schulze, William, 4945 Milwaukee Ave.
Schwartz, Albert A., 165 E. Erie St.
Seator, Sinclair M., 19 S. La Salle St.
Scribbins, John A., 22 W. Monroe St.
Seipp, Edwin A., 105 S. La Salle St.
Servic, Wm., 1644 Blue Island Ave.
Sexton, Frank A., 7 W. Madison St.
Seyfarth, Robert E., 134 S. La Salle St.
Shankland, Edward Clapp, 209 S. La Salle.
Shannon, James S., 740, 608 S. Dearborn St.
Shattuck, Walter F., 19 S. La Salle St.
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Sillani, Muzio, 2511 N. Clark St.
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Slovinec, John, 5138 S. Artesian Ave.
Slupkowski, Joseph A., 1263 N. Paulina St.

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Smith, Wm. H., 4654 Sheridan Rd.
Smith, Wm. Jones, 64 E. Van Buren St.
Smith, Z. Erol, 305 E. 55th.
Soderberg, Andrew F., 7211 Harvard Ave.
Sosna, Ned Irving, 39 W. Adams St.
Spencer, Charles B., 1830 Calumet Ave.
Spencer, Nelson S., 1830 Calumet Ave.
Spencer, R. C., Jr., 5 N. La Salle St.
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Spitzer, Maurice, 115 S. Dearborn St.
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Stanhope, Leon, 59 E. Madison St.
Stanton, Frederick C. H., 6010 Glenwood Ave.
Stebbings, Walter L., 53 W. Jackson Blvd.
Steif, Benjamin L., 64 W. Randolph St.
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Steinborn, Edward, 155 N. Clark St.
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Stern, Isaac S., 35 S. Dearborn St.
Steuben, Theo., 1331 Newport Ave.
Stevens, Chas. Whitney, 64 W. Randolph St.
Stevens, Harry E., 4022 W. Madison St.
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Stone, John R., 8 S. Dearborn St.
Strandel, Charles A., 118 N. La Salle St.
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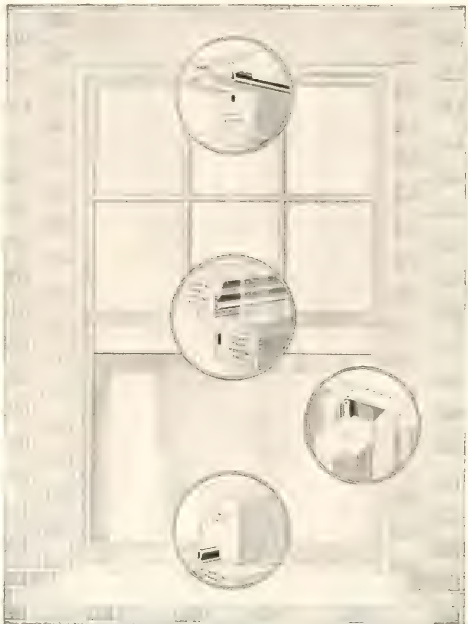

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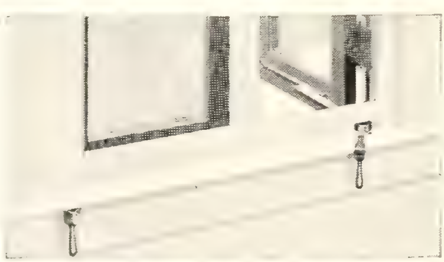

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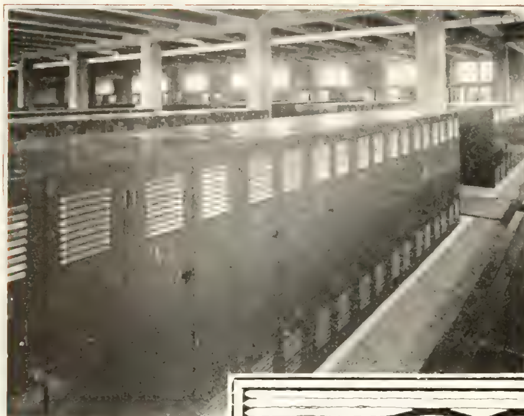

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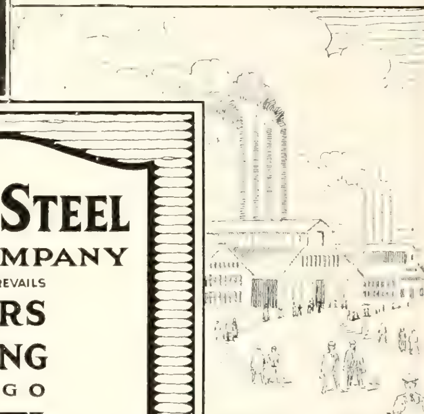

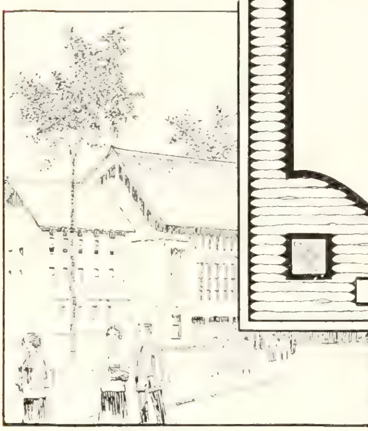

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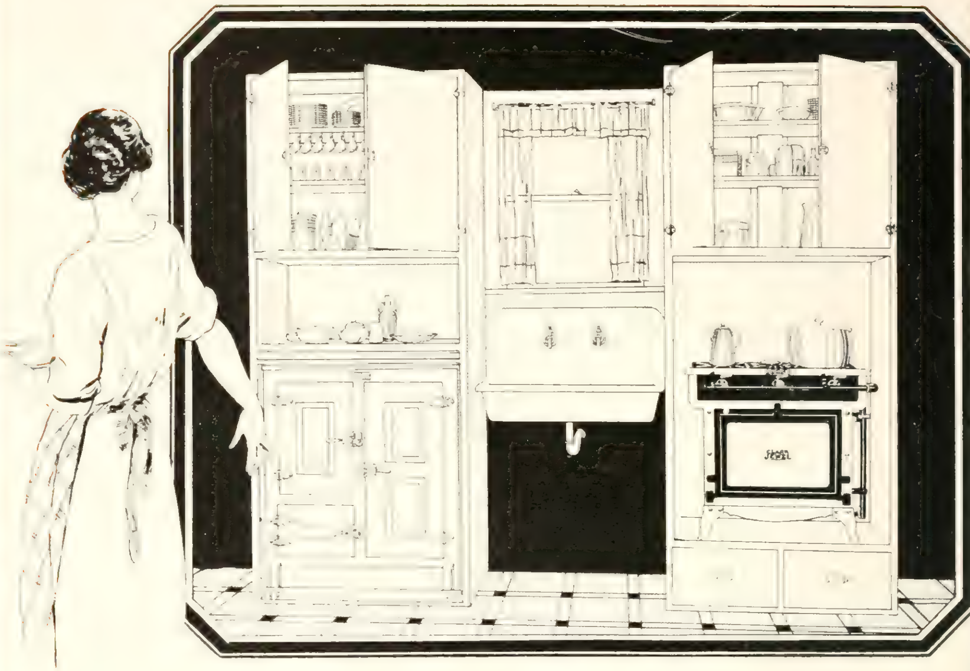

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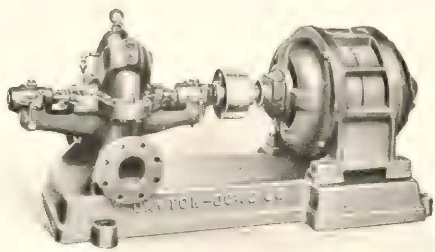

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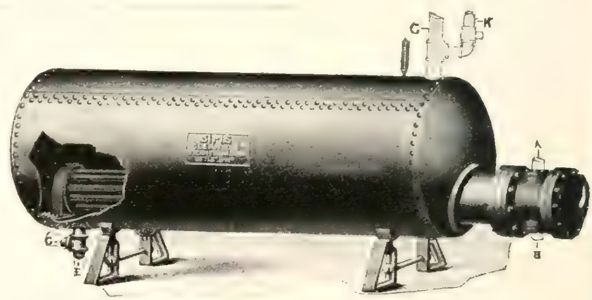

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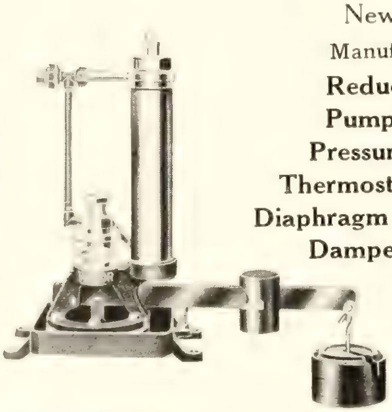

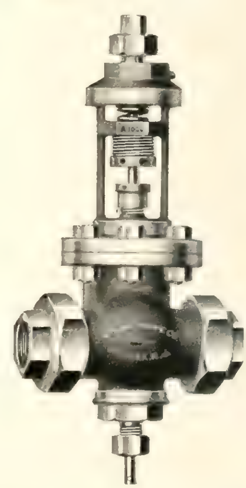

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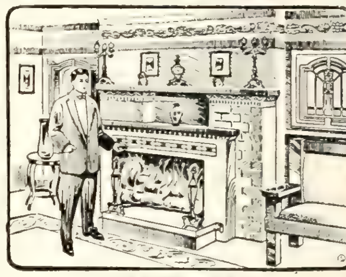

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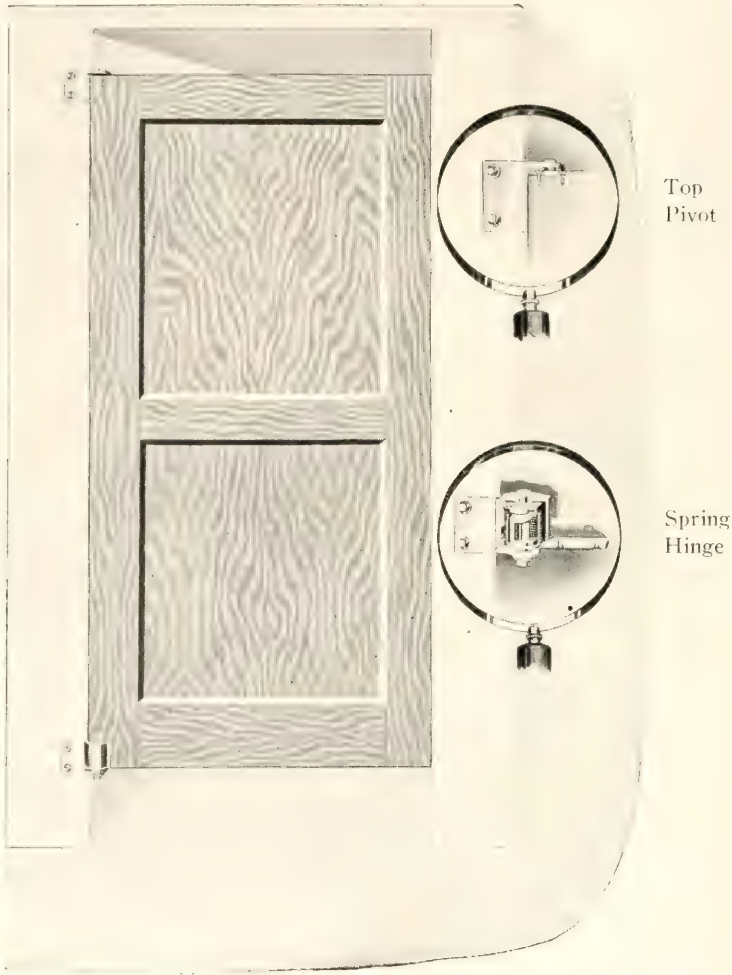
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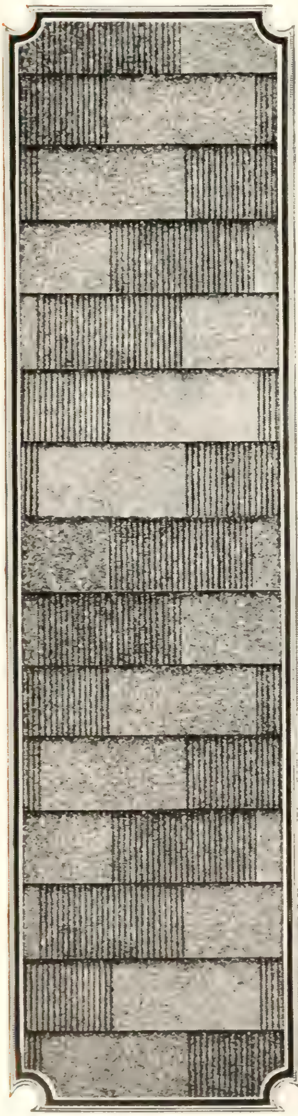

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Mallinger, John W., 3626 N. Racine Ave.
Marshall, Benjamin H., 721 N. Michigan Ave.
Matteson, Victor Andre, No. 1402, 8 S. Dearborn St.
McCarthy, Joseph W., 139 N. Clark St.
McLaren, Robert J., 1637 Prairie Ave.
Morehouse, Merritt J., 343 S. Dearborn St.
Morrison, J. R. M., 64 W. Randolph St.
Neebe, John K., 2522 Aubert Ave.
Nyden, John A., 190 N. State St.
Oliver, Ralph H., 115 S. Dearborn St.
Ostergren, Robert C., 155 N. Clark St.
Palmer, H. L., 19 S. La Salle St.
Perkins, Dwight H., 814 Tower Court
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Raeder, Henry, 20 W. Jackson Blvd.
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Royer, J. W., Flat Iron Bldg., Urbana, Ill.
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Spencer, N. S., 1830 Calumet Ave.
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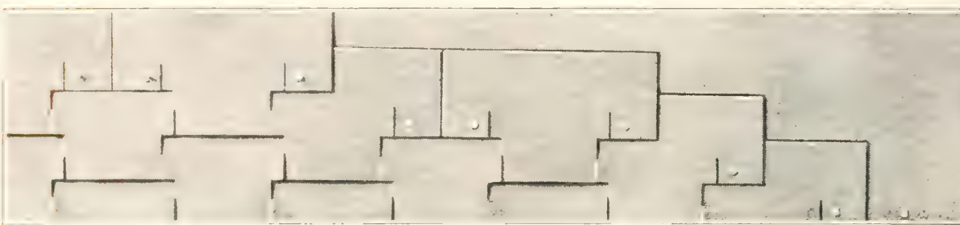
TEE-LOK—THE SUPER-INDIVIDUAL



THE TEE-LOK, laid as illustrated, automatically alignes itself on any roof and when laid, each shingle is firmly held down at eight points. A minimum thickness of two layers of tough, durable material covers a Tee-Lok roof. Its famous shadow-line surpasses the appearance of the most expensive tile. Weight 200 lbs. per square.

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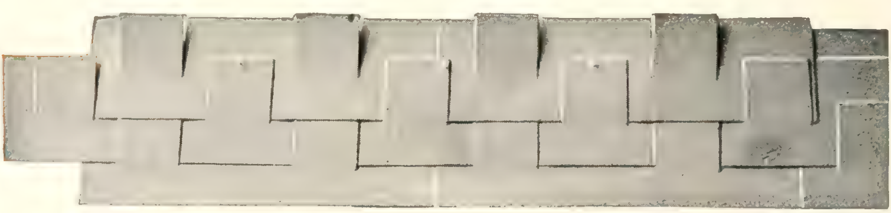

THE LOX-ON Strip Shingle combines the absolute security of the "locked-down-at-the-butt" type with the economy of the multiple shingle. It is laid as illustrated, three nails to the strip, and when laid, its basket-weave effect is singularly striking. Weight 190 lbs. per square.

Both shingles carry Class C label of the Underwriters Laboratories.

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General Offices:

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Telephone: Dearborn 6830

"THE ILLINOIS ARCHITECTURAL ACT"

ARCHITECTS LICENSE LAW
STATE OF ILLINOIS

For an Act to provide for the licensing of architects and to regulate the practice of architecture as a profession and to repeal certain Acts therein named.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: It shall be unlawful for any person to practice architecture or advertise or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect duly issued by the Department of Registration and Education under this Act, and as provided for in the civil administrative code of Illinois.

Sec. 2. Any one, or any combination of the following practices by a person shall constitute the practice of architecture, namely: The planning or supervision of the erection, enlargement or alteration of any building or buildings or of any parts thereof, to be constructed for others. A building is any structure consisting of foundations, floors, walls, columns, girders, beams and roof, or a combination of any number of these parts, with or without other parts.

Sec. 3. No corporation shall be licensed to practice architecture in this State or be granted a certificate of registration under this Act, but it shall be lawful for a stock company or a corporation to prepare drawings, plans and specifications for buildings and structures as defined in this Act which are constructed, erected, built, or their construction supervised by such stock company or corporation, provided that the chief executive officer or managing agent of such stock company or corporation in the State of Illinois shall be a registered architect under this Act; And, provided, further, that the supervision of such buildings and structures shall be under the personal supervision of said registered architect and that such drawings, plans and specifications shall be prepared under the personal direction and supervision of such registered architect and bear the stamp of his official seal.

It shall be lawful, however, for one or more registered architects to enter into a partnership with one or more licensed structural engineers, licensed under the laws of this State, for the practice of their professions.

Sec. 4. Nothing contained in this Act shall prevent the draftsmen, students, clerks of works, superintendents and other employees of those lawfully practicing as registered architects under the provisions of this Act, from acting under the instruction, control or supervision of their employers, or to prevent the employment of superintendents of the construction, enlargement or alteration of buildings or any parts thereof, or prevent such superintendents from acting under the immediate personal supervision of the registered architect by whom the plans and specifications of any such building, enlargement or alteration were prepared. Nor shall anything contained in this Act prevent persons, mechanics or builders from making plans, specifications for or supervising the erection, enlargement or alteration of buildings or any parts thereof to be constructed by themselves or their own employees for their own use, provided that the working drawings for such construction are signed by the authors thereof with a true statement thereon of their relation to such construction and that the makers thereof are not architects.

Provided nothing in this Act contained shall be held or construed to have any application to any building, remodeling or repairing of any building or other structure outside of the corporate limits of any city or village, **where** such **b**uilding or structure is to be, or is used for residential or farm purposes, or for the purposes of outbuildings or auxiliary buildings in connection with such residential or farm premises, nor shall said Act apply to any building remodeling or repairing of any building or structure within the corporate limits of any city or village, where the total cost of said building, remodeling or repairing does not exceed the sum of seventy-five hundred dollars.

Sec. 5. Any person who is twenty-one years of age and of good moral character is qualified for an examination for a certificate of registration as a registered architect, provided he or she has graduated from a high school or secondary school, approved by the Department of Registration and Education, or has completed an equivalent course of study as determined by an examination conducted by the Department of Registration and Education, and has subsequently thereto completed such course in mathematics, history and language, as may be prescribed by said Department, and has had at least three years' experience in the office or offices of a reputable architect or architects.

Sec. 6. Upon payment of the required fee, an applicant who is an architect, registered or licensed under the laws of another state or territory of the United States, or of foreign country or province, may, without examination, be granted a certificate of registration as a registered architect by the Department of Registration and Education in its discretion upon the followingg conditions:

(a) That the applicant is at least twenty-one years of age, of good character and temperate habits; and

(b) That the requirements for the registration or licensing of architects in the particular state, territory, county or province, were, at the date of the license, substantially equal to the requirements then in force in this State.

Sec. 7. Every person who desires to obtain a certificate of registration shall apply therefor to the Department of Registration and Education in writing, upon blanks prepared and furnished by the Department of Registration and Education. Each application shall be verified by the applicant under oath and shall be accompanied by the required fee.

Sec. 8. The Department of Registration and Education shall hold examinations of applicants for certificates of registration as registered architects at such times and places as it may determine.

The examination of applicants for certificates of registration as registered architects shall consist of written tests and shall embrace the following subjects:

(a) The planning, designing and construction of buildings.

(b) The strength of building materials.

(c) The principles of sanitation and ventilation as applied to buildings.

(d) The ability of the applicant to make practical application of his knowledge in the ordinary professional work of an architect and in the duties of a supervisor of mechanical work on buildings.

The Department of Registration and Education may by rule prescribe additional subjects for examination.

Sec. 9. Whenever the provisions of this Act have been complied with by an applicant the Department of Registration and Education shall issue a certificate of registration to the applicant as a registered architect, which certificate shall have the effect of a license to the person to whom it is issued to practice architecture in this State, subject to the provisions of this Act.

Any license or certificate of registration heretofore issued under the laws of this State authorizing its holder to practice architecture shall, during the unexpired period for

which it was issued, serve the same purpose as the certificate of registration provided for by this Act.

Sec. 10. Any person licensed to practice architecture in this State or registered as an architect under this Act shall be exempt from the provisions of any and all Acts in force in this State regulating the practice of structural engineering.

Sec. 11. Every holder of a certificate of registration as a registered architect shall display it in a conspicuous place in his principal office, place of business or place of employment.

Every registered architect shall have a seal, the impression of which shall contain the name of the architect and the words "Registered Architect," "State of Illinois." He shall stamp with this seal all working drawings and specifications prepared by him or under his supervision. Any seal heretofore authorized under the laws of this State shall serve the same purpose as the seal provided for by this Act.

Sec. 12. Every registered architect who continues in active practice shall, annually, on or before the first day of July, renew his certificate of registration and pay the required renewal fee. Every license or certificate of registration which has not been renewed during the month of July in any year, shall expire on the first day of August in that year. A registered architect whose certificate of registration has expired may have his certificate restored only upon payment of the required restoration fee.

Any architect registered or licensed in this State who has retired from the practice of architecture for a period of not more than five (5) years may have his certificate of registration renewed, at any time within a period of five (5) years after so retiring, upon making application to the Department for such renewal and upon payment of all lapsed annual renewal fees.

Sec. 13. The Department of Registration and Education may refuse to renew, or may suspend, or may revoke, any certificate of registration for any one or any combination of the following causes:

(a) Gross incompetency.

(b) Recklessness in the construction of buildings or their appurtenances.

(c) Dishonest practice.

(d) When the architect has been twice convicted for a violation of any of the provisions of this Act.

(e) A person who has by false or fraudulent representation obtained or sought to obtain a certificate of registration as an architect.

The Department of Registration and Education shall not refuse to renew, nor suspend, nor shall it revoke any certificate of registration for any of the above causes until the person accused shall have been given at least twenty (20) days' notice in writing of the charge against him and a public hearing upon such charge has been had by the Department of Registration and Education.

Upon the hearing of any such proceeding, the Director of Registration and Education, the Assistant Director of Registration and Education, or the Superintendent of Registration may administer oaths, and the Department of Registration and Education may issue subpoenas and procure and compel the attendance of and the giving of testimony by witnesses and may compel the production of any books and papers deemed relevant to the inquiry by the Department or by the persons designated by the Department under the Civil Administrative Code of Illinois to conduct such inquiry. The accused may have the subpoena of the Department of Registration and Education for his witnesses, and may be heard in person and by counsel, in open public hearing.

Any circuit court, or any judge of a circuit court, either in term time or in vacation, upon the application either of the Department of Registration and Education or of the accused may, by order duly entered, require the attendance and enforce the giving of testimony of such witnesses and require the production of such books and papers as are above in this section referred to before the Department of Registration and Education or the persons designated by said Department under said Civil Administrative Code to conduct the inquiry in any hearing relating to the refusal, suspension, renewal or revocation of any certificate of registration. Upon refusal or neglect to obey the order of the said court or judge, the said court or judge may compel, by attachment or proceedings for contempt of courts, or otherwise, obedience to the order.

Sec. 14. The fee to be paid by an applicant for an examination to determine his fitness to receive a certificate of registration as a registered architect shall be ten dollars ($10).

The fee to be paid by an applicant for a certificate of registration as a registered architect shall be five dollars ($5).

The fee to be paid for the restoration of an expired certificate of registration shall be five dollars ($5).

The fee to be paid upon renewal of a certificate of registration shall be one dollar ($1).

The fee to be paid by an applicant for a certificate of registration who is an architect registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, shall be fifteen dollars ($15).

Sec. 15. The Department of Registration and ducation shall adopt rules and regulations in accordance with the provisions of section 60 of said Civil Administrative Code, and not inconsistent with this Act, to carry out fully and enforce the provisions of this Act.

Sec. 16. Each of the following Acts constitutes a misdemeanor punishable upon conviction by a fine of not less than twenty-five dollars ($25) nor more than two hundred dollars ($200) for each offense:

(a) The practice of architecture by any person or the advertising or putting out of any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect issued by the Department of Registration and Education of this State.

(b) The making of any willfully false oath or affirmation in any matter or proceeding where an oath or affirmation is required by this Act.

(c) The affixing of a registered architect's seal to any plans, specifications or drawings which have not been prepared by him or under his immediate personal supervision.

(d) The violation of any provision of Section 11 of this Act.

All fines and penalties shall inure to the Department of Registration and Education of this State.

Sec. 17. The Department of Registration and Education shall keep a record open to public inspection at all reasonable times of its proceedings relating to the issuance, refusal, renewal, suspension and revocation of certificates of registration. This record shall also contain the name, place of business and residence, and the date and number of registration of each registered architect in this State.

Sec. 18. The following Acts are hereby repealed: "An Act to provide for the licensing of architects and regulating the practice of architecture, as a profession," approved June 3, 1897, and in force July 1, 1897, and the following Acts amendatory thereof, to-wit: An Act approved April 19, 1899, and in force July 1, 1899. An Act approved May 16, 1905, and in force July 1, 1905; and an Act approved May 26, 1911, and in force July 1, 1911.

Sec. 19. This Act may be known and cited as "The Illinois Architectural Act."

EXTRACTS FROM THE NEW CIVIL ADMINISTRATIVE CODE OF THE STATE OF ILLINOIS

Which Affects the practice of the Architectural Profession in this State

An Act in relation to the civil administration of the State government, and to repeal certain Acts therein named. [Approved March 7, 1917, in force July 1, 1917.]

GENERAL PROVISIONS.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: This Act shall be known as "The Civil Administrative Code of Illinois."

Sec. 2. The word "department," as used in this Act shall, unless the context otherwise clearly indicates, mean the several departments of the State government as designated in Section 3 of this Act, and none other.

Sec. 3. Departments of the State government are created as follows:

The department of finance;
The department of agriculture;
The department of labor;
The department of mines and minerals;
The department of public works and buildings;
The department of public welfare.
The department of public health;
The department of trade and commerce;
The department of registration and education.

Sec. 4. Each department shall have an officer at its head who shall be known as a director, and who shall, subject to the provisions of this Act, execute the powers and discharge the duties vested by law in his respective department.

Sec. 5. In addition to the directors of departments, the following executive and administrative officers, boards and commissions, which said officers, boards and commissions in the respective departments, shall hold offices hereby created and designated as follows:

In the Department of Public Works and Buildings.

Assistant director of public works and buildings;
Superintendent of highways;
Supervising architect;
Supervising engineer;
Superintendent of waterways;
Superintendent of printing;
Superintendent of purchases and supplies;
Superintendent of parks.

In the Department of Registration and Education.

Assistant director of registration and education.
Superintendent of registration;
The normal school board, which shall consist of nine officers, together with the director of the department and the Superintendent of Public Instruction. The above named officers, and each of them, shall, except as otherwise provided in this Act, be under the direction, supervision and control of the director of their respective departments, and shall perform such duties as such director shall prescribe. [Amended by Act approved June 24, 1921.]

Sec. 6. Advisory and non-executive boards, in the respective departments, are created as follows:

In the Department of Registration and Education.

Neither the Director, Assistant Director, Superintendent of Registration, nor any other executive and administrative officer in the Department of Registration and Education shall be affiliated with any college or school of medicine, pharmacy, dentistry, nursing, optometry, embalming, barbering, veterinary medicine and surgery, architecture, or structural engineering, either as teacher, officer or stockholder, nor shall he hold a license or certificate to exercise or practice any of the professions, trades or occupations regulated.

The Department of Registration and Education:

The director of registration and education shall receive five thousand dollars;
The assistant director of registration and education shall receive three thousand six hundred dollars;

The superintendent of registration shall receive four thousand two hundred dollars.

10. No member of an advisory and non-executive board shall receive any compensation.

11. Each executive and administrative officer, except the two food standard officers, the members of the mining board, and the members of the normal school board shall devote his entire time to the duties of his office and shall hold no other office or position of profit.

12. Each officer whose office is created by this Act shall be appointed by the Governor, by and with the advice and consent of the Senate. In any case of vacancy in such offices during the recess of the Senate, the Governor shall make a temporary appointment until the next meeting of the Senate, when he shall nominate some person to fill such office; and any person so nominated, who is confirmed by the Senate, shall hold his office during the remainder of the term until his successor shall be appointed and qualified. If the Senate is not in session at the time this Act takes effect, the Governor shall make a temporary appointment as in case of a vacancy.

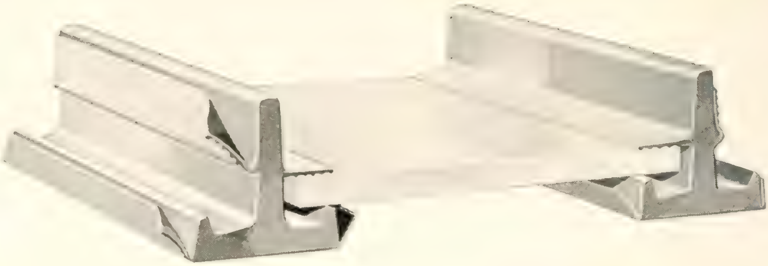
14. Each officer whose office is created by this Act shall, before entering upon the duties of his office, take and subscribe the constitutional oath of office, which shall be filed in the office of the Secretary of State.

15. Each executive and administrative officer whose office is created by this Act shall, before entering upon the discharge of the duties of his office, give bond, with security to be approved by the Governor, in such penal sum as shall be fixed by the Governor, not less in any case than ten thousand dollars, conditioned for the faithful performance of his duties, which bond shall be filed in the office of the Secretary of State.

16. The director of each department is empowered to prescribe regulations, not inconsistent with law, for the government of his department, the conduct of its employees and clerks, the distribution and performance of its business and the custody, use and preservation of the records, papers, books, documents, and property pertaining thereto.

17. Each department shall maintain a central office in the capitol building at Springfield, in rooms provided by the Secretary of State. The director of each department may, in his discretion and with the approval of the Governor, establish and maintain, at places other than the seat of government, branch offices for the conduct of any one or more functions of his department.

18. Each department shall be open for the transaction of public business at least from eight-thirty o'clock in the morning until five o'clock in the evening of each day except



Sundays and days declared by the negotiable instrument Act to be holidays.

19. Each department shall adopt and keep an official seal.

20. Each department is empowered to employ, subject to civil service laws in force at the time the employment is made, necessary employees, and, if the rate of compensation is not otherwise fixed by law, to fix their compensation.

Sec. 25. Each director of a department shall annually on or before the first day of December, and at such other times as the Governor may require, report in writing to the Governor concerning the condition, management and financial transactions of his respective department. In addition to such reports, each director of a department shall make the semi-annual and biennial reports provided by the Constitution. The departments shall make annnual and biennial reports at the time prescribed in this section, and at no other time.

26. The directors of departments shall devise a practical and working basis for cooperation and coordination of work, eliminating duplication and overlapping of functions. They shall, so far as practicable, cooperate with each other in the employment of services and the use of quarters and equipment. The director of any department may empower or require an employee of another department, subject to the consent of the superior officer of the employee, to perform any duty which he might require of his own subordinates.

27. The gross amount of money received by every department, from whatever source, belonging to or for the use of the State, shall be paid into the State treasury, without delay, not later in any event than ten days after the receipt of the same, without any deduction on account of salaries, fees, costs, charges, expenses or claim of any description whatever. No money belonging to, or for the use of, the State shall be expended or applied by any department except in consequence of an appropriation made by law and upon the warrant of the Auditor of Public Accounts.

35. The following offices, boards, commissions, arms, and agencies of the State government heretofore created by law, are hereby abolished, viz.:

State board of examiners of architects, State board of examiners of structural engineers, secretary of the State board of examiners of structural engineers, secretary-treasurer of the State board of examiners of architects, State inspector of masonry, public buildings and works, assistant State inspectors of masonry, public buildings and works, the board of administration.

The Department of Public Works and Buildings.

49. The department of public works and buildings shall have power:

1. To exercise the rights, powers and duties vested by law in the State highway department, the State highway commission, the chief State highway engineer, the assistant State highway engineer, and other officers and employees of the State highway service;

2. To exercise the rights, powers and duties vested by law in "The Canal Commissioners," their officers and employees;

3. To exercise the rights, powers and duties vested by law in the rivers and lakes commission of Illinois, its officers and employees;

4. To exercise the rights, powers and duties vested by law in the Illinois waterway commission, its secretary, chief engineers, its other officers and employees;

5. To exercise the rights, powers and duties vested by law in the Illinois park commission, its officers and employees;

6. To exercise the rights, powers and duties vested by law in the Fort Massac trustees, their officers and employees;

7. To exercise the rights, powers and duties vested by law in the Lincoln homestead trustees, their officers and employees;

8. To exercise the rights, powers and duties vested by law in the board of commissioners of and for the Lincoln monument grounds, its officers and employees;

9. To exercise the rights, powers and duties vested by law in the superintendent of printing, his officers and employees;

10. To make contracts for and superintend the telegraph and telephone service for the several departments;

11. To purchase and supply all fuel, light, water and other like office and building services for the several departments except where the same are now supplied by the Secretary of State.

12. To procure and supply all furniture, general office equipment and general office supplies (other than stationery and office supplies distributed through the office of the Secretary of State) needed by the several departments;

13. To procure and supply all clothing, instruments and apparatus, subsistence and provisions for the charitable, penal and reformatory institutions;

14. To procure and supply all cots, beds, bedding, general room and cell equipment, table, kitchen and laundry equipment, agricultural implements, harness, stable and garage supplies, household supplies, periodicals, machinery and tools, medicines and medical supplies, plumbing, light and engine supplies, wagons and other vehicles and workshop supplies needed by the several departments;

14a. To purchase and supply all necessary tools, machinery, supplies and materials to be used by the State in or about constructing or maintaining State highways;

15. To prepare, or cause to be prepared, general plans, preliminary sketches and estimates for the public buildings to be erected for any department;

16. To have general supervision over the erection and construction of public buildings erected for any department, and over the inspection of all materials previous to their incorporation into such buildings or work;

17. To make contracts for, and supervise the construction and repair of buildings under the control of any department;

18. To prepare and suggest comprehensive plans for the development of grounds and buildings under the control of any department;

19. To make and provide all drawings, plans, specifications and models for the construction and perfection of all systems of sewerage, drainage and plumbing for the State in connection with the buildings and grounds under the control of any department;

20. To erect, supervise and maintain all public monuments and memorials erected by the State except where the supervision and maintenance thereof is otherwise provided by law;

21. To lease, for a term not exceeding two years, storage acommodations for the several departments;

22. To lease, for a term not exceeding two years, unproductive and unused lands or other property under the control of any department, unless longer leases thereof are expressly authorized by some law enforced by the department;

23. To lease, for a term not exceeding two years, office space in buildings for the use of the several departments;

24. To have general supervision and care of storerooms and offices leased for the use of the departments.

50. The advisory and non-executive boards in the department of public works shall discharge the following advisory powers and functions:

The board of art advisors shall advise to the artistic character of State buildings, works and monuments, now or hereafter constructed, and to any work of a permanent character intended for decoration or commemoration;

The board of water resource advisors shall advise relative to riparian rights of the State, and the conservation, use and development of water resources;

The board of highway advisors shall advise relative to the construction, improvement and maintenance of State highways;

The board of park and buildings advisors shall advise relative to the construction, improvement and maintenance of State parks, buildings and monuments.

51. The director of public works is authorized, with the consent in writing of the Governor, to acquire, by private purchase or by condemnation under the eminent domain Act, the necessary lands for the public buildings and grounds for the departments.

52. All moneys received by the director of public works from rents, leases, sale of property or from any other source in connection with the management of the Illinois and Michigan Canal shall be covered into the State treasury, and shall be placed by the State Treasurer to the credit of a special fund to be known as the "Illinois and Michigan Canal fund."

The Department of Registration and Education.

58. The department of registration and education shall have power:

1. To exercise the rights, powers and duties vested by law in the board of education of the State of Illinois, the board of trustees of the Southern Normal University at Carbondale, the board of trustees of the Northern Illinois State Normal School at DeKalb, the board of trustees of the Eastern Illinois State Normal School at Charleston, and the board of trustees of the Western Illinois State Normal School at Macomb;

2. To exercise the rights, powers and duties vested by law in the board of veterinary examiners and the State board of live stock commissioners relating to the practice of veterinary medicine and surgery in the State of Illinois;

3. To exercise the rights, powers and duties vested by law in the board of examiners of horseshoers;

4. To exercise the rights, powers and duties vested by law in the State board of examiners of architects;

5. To exercise the rights, powers and duties vested by law in the State board of examiners of structural engineers.

60. The department of registration and education shall, wherever the several laws regulating professions, trades and occupations which are devolved upon the department for administration so require, exercise, in its name, but subject to the provisions of this Act, the following powers:

1. Conduct examinations to ascertain the qualifications and fitness of applicants to exercise the profession, trade or occupation for which an examination is held; and pass upon the qualifications of applicants for resiprocal licenses, certificates and authorities;

2. Prescribe rules and regulations for a fair and wholly impartial method of examination of candidates to exercise the respective professions, trades or occupations;

3. Prescribe rules and regulations defining, for the respective professions, trades and occupations, what shall constitute a school, college or university, or department of a university, or other institutions, reputable and in good standing and to determine the reputability and good standing of a school, college or university, or department of a university, or other institution, reputable and in good standing by reference to a compliance with such rules and regulations;

4. Adopt rules providing for and establishing a uniform and reasonable standard of maintenance, instruction and training to be observed by all schools for nurses which are to be deemed reputable and in good standing and to determine the reputability and good standing of such schools for nurses by reference to compliance with such rules and regulations;

5. Establish a standard of preliminary education deemed requisite to admission to a school, college, or university, and to require satisfactory proof of the enforcement of such standard by schools, colleges and universities;

6. Conduct hearings on proceedings to revoke or refuse renewal of licenses, certificates or authorities of persons exercising the respective professions, trades or occupations, and to revoke or refuse to renew such licenses, certificates or authorities;

7. Formulate rules and regulations when required in any act to be administered.

None of the above enumerated functions and duties shall be exercised by the department of registration and education, except upon the action and report in writing of persons designated from time to time by the director of registration and education to take such action and to make such report, for the respcetive professions, trades and occupations as follows:

For the architects, five persons, one of whom shall be a member of the faculty of the University of Illinois, and the other four of whom shall be architects residing in this State, who have been engaged in the practice of architecture at least ten years;

For the structural engineers, five persons, one of whom shall be a professor in the civil engineering department of the University of Illinois, and the others of whom shall be structural engineers of recognized standing, who have had not less than ten years' practical experience, then practicing as structural engineers in this State.

The action or report in writing of a majority of the persons designated for any given trade, occupation or profession, shall be sufficient authority upon which the director of registration and education may act.

In making the designations of persons to act for the several professions, trades and occupations, the director shall give due consideration to recommendations by members of the respective professions, trades and occupations and by organizations therein.

Whenever the director is satisfied that substantial justice has not been done either in an examination or in the revocation of or refusal to renew a license, certificate or authority, he may order reexaminations or rehearings by the same or other examiners.

61. All certificates, licenses and authorities shall be issued by the department of registration and education, in the name of such department, with the seal thereof attached.

Repeal.

64. The following Acts and parts of Acts are hereby repealed:

"An Act creating the office of supervising architect of the State of Illinois and defining his powers and duties," approved April 24, 1899, in force July 1, 1899;

"An Act creating the office of supervising engineer for the General Assembly, its members and committees, and the Board of Administration of the State of Illinois, and fixing his compensation," approved June 10, 1911, in force July 1, 1911;

"An Act to create a State art commission, and to define its powers and duties," approved June 4, 1909, in force July 1, 1909;

An Act creating the office of State inspector of masonry, public buildings and works, and prescribing qualifications, duties and compensation," approved June 28, 1915, in force July 1, 1915.

OFFICE PRACTICE

Circular of Advice by Illinois Society of Architects Adopted April 28, 1914.

Believing that uniform practice in various architects' offices is desirable for all concerned, this Society recommends that the following conditions prevail in architects' offices of the State of Illinois:

Classification of Employes.

First. That employes be classed as Regular and Special;

Second. Employes classified as "Regular" will be those continually engaged for a period of not less than one year, on a weekly salary basis; it is expected that such employes will assume greater responsibilities to their employers and be granted special privileges, in consideration of faithful service;

Third. Employes classified as "Special" will be those engaged temporarily. It is deemed proper that such employes be paid by the hour for actual service rendered, making no allowance for vacations or holidays, it being considered fair under these circumstances to allow these draughtsmen a slightly higher rate per hour than regular employes who enjoy privileges of vacations and holidays.

Office Hours.

First. It is understood that draughtsmen are expected to be in their respective offices ready to begin actual work at the hours stated, and that they will continue in service at least until the hours fixed for cessation of work;

Second. The regular opening time of offices shall be 8:30 A. M., throughout the year;

Third. Period of service for Monday, Tuesday, Wednesday, Thursday and Friday, in the morning, shall be four hours, extending to 12:30 P M., that the lunch hour shall be one hour, extending from 12:30 to 1:30 P. M.; that the afternoon period shall be four hours, extending from 1:30 to 5:30 P. M.;

Fourth. That the Saturday period of service shall consist of 4½ hours, extending from 8:30 A. M. continously to 1:00 P. M.

Units of Service.

First. One week's service will consist of 44½ hours;

Second. One year's service will consist of 2,180½ hours.

Pay-Day.

First. That pay-day shall be on Monday of every week;

Second. That each pay-day draughtsmen be paid up to the Saturday night preceding.

Holidays and Vacations.

First. We recommend that "Regular" draughtsmen be given the following holidays on full pay: New Year's, Decoration Day, July Fourth, Labor Day, Thanksgiving, Christmas;

Second. That all "Regular" draughtsmen having been in the employ of an architect for more than one year be given two weeks' vacation on full pay, at time most convenient for employer;

Third. It should be understood that "Regular" draughtsmen, quitting the employer's service of their own volition, preceding the completion of any year's service, shall not be entitled to vacation allowance;

Fourth. "Regular" employes terminating service at the request of their employer shall be entitled to an allowance in cash proportionate to two weeks' salary allowed for vacation in the same ratio as period of service bears to one year;

Fifth. Vacations and holidays are understood to be granted to employes for rest and recuperation, the employe being understood to be in the service of the employer during vacation and holiday time just to the same extent as when regularly engaged in the office;

Sixth. It is recognized that an average of 44½ hours per week's service is the maximum efficient service that can be continuously rendered without detriment to the health or efficiency of the employe, and that where the employe engages in outside architectural service of any sort for others, he does so at the expense of his employer, and his employer should be credited for corresponding loss of time. The practice of employes of one employer working nights or holidays for another is condemned as detrimental to the best interests of both employer and employe;

Seventh. In case of emergencies of short duration, "Regular" employes are expected to work over-time for the employer without extra remuneration other than a reasonable allowance for the expense of taking meals away from regular lodging place. In such cases, however, the employes will be credited with off time on account of sickness or otherwise, equivalent to the amount of overtime service rendered in cases of emergency;

Eighth. Draughtsmen are encouraged, however, to make use of a portion of their time off for educational improvement.

Illinois Society of Architects,
1211-19 S. LaSalle.

Illinois Society of Architects

Suite 1211, 19 S. La Salle Street, Chicago.

The following is a list of the publications of the Society; further information regarding same may be obtained from the Financial Secretary.

FORM NO. 21, "INVITATION TO BID"—Letter size, 8½x11 in., two-page document, in packages of fifty at **75c,** broken packages, two for **5c.**

FORM NO. 22, "PROPOSAL"—Letter size, 8½x11 in., two-page documents, in packages of fifty, at **75c,** broken packages, two for **5c.**

FORM NO. 23, "ARTICLES OF AGREEMENT"—Letter size, 8½x11 in., two-page document, in packages of fifty, at **75c,** broken packages, two for **5c.**

FORM NO. 24, "BOND"—Legal size, 8x13 in., one-page document, put up in packages of twenty-five, at **25c** per package, broken packages, three for **5c.**

FORM NO. 25, "GENERAL CONDITIONS OF THE CONTRACT"—Intended to be bound at the side with the specifications, letter size, 8½x11 in., ten-page document, put up in packages of fifty at **$2.50,** broken packages, three for **25c.**

FORM 26, CONTRACT BETWEEN ARCHITECT AND OWNER. Price, **5c** each, in packages of fifty,**$1.25.**

THE ANNUAL—A handbook containing useful information for Architects and Builders and the building code of the City of Chicago, distributed free to Architects licensed to practice in Illinois. Price to others, cloth binding, **$2.00;** leather binding, **$2.50.**

FORM 1, BLANK CERTIFICATE BOOKS—Carbon copy, form 3¾x8½ in., price, **50c.** two for **5c.**

FORM 4, CONTRACT BETWEEN THE OWNER AND CONTRACTOR—(Old Form.) Price, two for **5c,** five for **10c,** put up in packages of 50 for **$1.00.**

FORM E, CONTRACTOR'S LONG FORM STATEMENT—As required by lien law. Price, two for **5c.**

FORM 13, CONTRACTOR'S SHORT FORM STATEMENT—Price, **1c** each.

CODES OF PRACTICE AND SCHEDULE OF CHARGES 8½x11 in. Price, five for **10c.**

These documents may be secured at the Financial Secretary's office, suite 1211, 19 S. La Salle St., telephone Cent. 4214. We have no delivery service. The prices quoted above are about the cost of production. An extra charge will be made for mailing or expressing same. Terms strictly cash, in advance, with the order; except that members of the Society may have same charged to their account.

SUGGESTIONS FOR FIRMS ISSUING CATALOGUES AND PRINTED MATTER

Architects are technically educated and are charged with selection on technical merit.

Exact and specific technical detail appeals to an architect because it enables him to judge quickly and correctly.

Drawings to scale of parts or the whole make arrangement or mechanism most quickly clear to the technically educated.

Testimonials from those technically incompetent to judge carry no weight with the competent.

Architects want authentic technical information about all building materials and devices.

Architects do not want to wade through a sea of laudatory verbiage in order to discover an islet of real usable information.

Architects must cover an immense variety and amount of detail in selecting the numerous materials that enter into a building.

Where much detail is handled by a single individual, success is dependent on system.

Information to be immediately available for architects must be classified so that each detail can be considered separately and in order.

Advertisers recognizing these principles and presenting exact technical information under proper classification, free from irrelevant matter and in convenient form for filing, so as to be available when that item is up for consideration, are most likely to secure satisfactory results from their efforts.

It is believed that most architects have their own particular system of filing and classification and would not take kindly to any advertising scheme contemplating the placing of filing cabinets in architects' offices and distribution by those interested in the promotion of advertising scheme. Architects do not take kindly to allowing outsiders access to their private catalogue filing cabinets, and it is impractical to have two filing systems in the same office.

Practical requirements in the preparation of specifications make it necessary for architects to divide their specifications into topics very similar to trade divisions brought about by divisions of labor promulgated by labor authorities, and no single division or chapter of a catalogue should contain matter pertaining to more than one trade; unless the material referred to is used by several trades. It is hoped that eventually the architects may agree on a satisfactory universal building material classification or index. But it is certain that this time has not yet arrived and that no person not actually having had extended experience in the preparation of architects' specifications is capable of preparing such an index that would be practical.

STANDARD SIZES
Requested by Architects

Believing that uniform practice by the various publishers of catalogues and literature for distribution to architects is desirable for all concerned, and wishing to be in accord with the recommendations of the American Institute of Architects, the Illinois Society of Architects advise that all literature for this purpose be prepared to comply as nearly as possible with the conditions set forth, as follows:

First: That 8½"x11" shall be the standard sized page for all general catalogues and bulletins intended for permanent filing by architects; thus making a size convenient for filing in the standard letter-size vertical filing cabinets, such as may be procured from any concern dealing in office filing devices.

Second: That 3¾"x8½" shall be the standard size for post cards and pocket editions intended for the use of architects; thus making a size convenient for filing three to the page, side by side, in standard letter-size vertical filing cabinets; or one to the page, on side, in standard vertical check files; or on end in standard legal document files; also convenient for mailing in standard legal size envelopes.

Third: That all catalogues should be issued in the form of separate bulletins, or chapters separated by a blank page, each treating of but one subject, on both sides of the same sheet, so as to make separation easy for classification purposes.

Fourth: That it is important to have pages cut to exact size; if over size in any particular they may not go into files; if under size, they may be overlooked in running through the files hastily.

Fifth: That these recommendations go into effect January 1, 1915, and that following that date, architects be advised to decline to receive literature for filing which does not comply with standard sizes.

Illinois Society of Architects

NATIONAL COUNCIL OF ARCHITECTURAL REGISTRATION BOARDS

Introductory Statement.

1. Briefly stated, the Council constitutes a learing house for the convenience of the egistration authorities of the various states aving laws regulating the practice of archiecture. Its active membership is composed f such states. Its membership is not elected, but is constituted of those States whose egistration authorities subcribe to its Constitution and By-Laws and pay the annual nembership fee. No State which has a law egulating the practice of architecture can e denied membership in the Council, provided its legally constituted officials sign an pplication blank, pay the required membership fee, and deposit five copies of its Architectural Act and of the Rules and Regulaions promulgated by its examining commitee or board for the purpose of regulating xaminations.

2. The franchise of the Council is inherent n its active members. In other words, the ontrol of the Council is absolutely in the ands of the architectural registration auhorities of the various States which are nembers of the Council, each State being entitled to only one vote, even though repreented by several of its officials. The officers f the Council are elected by the active memers to carry out their will.

I. Reciprocal Transfer of Registration.

It is expected that architects desiring eciprocal transfer of registration from one tate to another will find it convenient and ractical to effect this transfer through the nedium of the National Council of Archiectural Registration Boards. For in most ases where this method is followed, the aplicant will be saved the necessity of a personal appearance and examination before any xamining committee other than that of his ome State. While the Council does not uarantee the acceptance of all applicants vho apply for transfer of registration hrough the Council, it is in a position to nd does furnish State examining committees with the results of an unprejudiced and lisinterested investigation of the applicant's redentials, moral, educational, and legal. Vith this data in hand the examining auhorities in the State to which the appliant desires transfer are furnished evidence vhich is usually considered sufficient upon vhich to predicate judgment as to the aplicant's availability for registration in acordance with the laws of that State.

II. Examinations.

Because of its close relationship with the arious examining authorities, the Council s in a position to facilitate uniformity of xaminations. Where legal restrictions do ot permit the local examining committees o give examinations equal in stringency to hose recommended by the Council as just nd proper, the Council with the co-operaion of the local examining committees may rrange voluntary examinations meeting the ninimum requirements recommended by the ouncil. The laws in the different States ary materially and probably always will ary, and since these laws affect examinaions the legal examination requirements in ifferent States may be expected to continue o differ. Some States emphasize preliminary ducation as of paramount importance and lace very little credence in examinations. ther States emphasize the importance of xaminations as a greater consideration than he educational record. Some States are only oncerned with the question of the appliant's proficiency in matters falling under he police power of the State (i. e., the conervation of life, health and property). Other tates base their requirements on broad eduational standards and value aesthetic skill s equal to skill in matter of safety to human life, conservation of property and protection of health. Many requirements are common to all States. Therefore, the successful passing of an examination in any State should eliminate further requirement for an examination on work passed in the State of first examination.

III. Standard N. C. A. R. Examinations.

The Council has devised an examination standard which it has been pleased to designate as the "Standard N. C. A. R. Examination" and which is intended to cover the minimum requirements for registration in all States. The Council suggests the advisability of supplementing the regular examination of the State of applicant's residence with this additional examination. It being understood that while the examination is conducted under the supervision of the National Council and in strict accord with the rules promulgated by that body, that it is actually conducted by the State examining committee of the State of applicant's residence. Preliminary to such examinations, the applicant must apply to the Council and have his record in practice very carefully investigated, written up, and furnished to the local examining committee as part of the material which it must use in determining the applicant's right to the status, "Registered in Accord with the Standard N. C. A. R. Examination Requirements."

IV. Junior Examinations.

1. Junior applicants (i. e., men having had less than ten years' practice as principals), who have passed the regular State examination in their home States, are only required to pass a written examination covering the difference between their home State examination requirements and those of the National Council of Architectural Registration Boards; but they must submit evidence of attainment since entering practice and evidence of attainment before practice. Of course, if they have not been engaged in practice, they will only have to submit evidence of attainment before practice. But this fact should be emphasized—that no essential part of their records from the time that they left elementary school up until the date of their applications for examination shall be missed from the investigation. Baldly stated, they must never have been found guilty of dishonorable practice, recklessness, or carelessness in connection with the designing, erection, or supervision of buildings. Their preparation for practice must be shown to have been adequate and their practical skill in applying theoretical knowledge demonstrated both by written examination and by practical experience.

2. The Standard N. C. A. R. Examination is purely a voluntary examination. No one is compelled to take it and no one will be allowed to take it who does not seem to have had adequate preparation to justify such an examination. In the interests of fair play, large discretionary power and liberal instructions are given to the examining committee in determining the equivalent of prescribed preparation.

V. Senior Examination.

The Standard N. C. A. R. Examination for those falling under the Senior classification (i. e., men having had ten or more years' experience as principals) is based very largely on proved attainment in practice. The Council assumes that no competent man having had ten years' experience as a directing head of an architect's office should be entitled to take the status "Registered by N. C. A. R. Examination" who cannot demonstrate to the entire satisfaction of the examining jury that he has at some time during his practice actually been engaged in the competent performance of the five fundamental functions

f an architect, namely: the preparation of reliminary studies, general drawings, specifications, details, and the general supervision f the work, including all incidental items f practice which go with the performance f these various functions. With this understanding, it might be possible for a man o have had unusually complete academic nd technical school preparation and yet fail n the Senior Standard N. C. A. R. Examination, if it should be proved that he was unable to apply or never had applied his theoretical knowledge in the performance of ach of the fundamental functions of an rchitect at some time during his architectural practice.

VI. Service of Council.

To employ the services of the Council, an rchitect should proceed about as follows: 'o obtain reciprocal transfer from one State o another, the applicant should write to the ecretary of the National Council of Architectural Registration Boards, at 1107-64 East 'an Buren Street, Chicago, Illinois, and ask or an Application Blank for reciprocal transfer from his home State or the State of his resent registration to the State where he esires registration by transfer, stating the ollowing facts:

1. Date and number of his home State egistration.
2. A definite statement as to whether he vas registered in his home State by examination or by exemption.
3. The number of years that he has been ngaged in practice as a principal or one of he principal directing heads of an architect's office actually engaged in the practice f architecture as a profession.
4. The applicant should enclose with this etter a par value check for Fifteen Dollars $15.00) made payable to the National Counil of Architectural Registration Boards, to over the fee charged by the Council to deray the expenses of investigating the applicant's record and transmitting the results of hat investigation to the State where the aplicant desires transfer of registration.
5. Upon the receipt of the before-mentioned tatement and payment of fee, the Secretary f the National Council will forward to the pplicant an Application Blank and an Information Blank which should in due course e filled out by the applicant, certified to by a Notary Public and returned to the Council as basis for its investigation. Too much emhasis cannot be laid on the importance of sing great care in filling out the Information Blank and making the statements as ompletely comprehensive as space will pernit. Since the Information Blank must be eproduced in facsimile, it is very important hat the ink used in filling in answers to the arious questions shall be black opaque, suseptible to photographic or blue-print reproluction. Common drafting ink is the most ractical. The typewriter may be used if he paper is backed with a fresh black caron, so as to form a good blue-print negaive. Actual dates of attendance at schools re important. Addresses of school princials, registrars, secretaries of societies, lients, and architectural references should e accurately given. Much delay has reulted from failure to give this information orrectly. Inaccurate or incomplete infornation only delays the completion of the ecord, as no record will be forwarded to the xamining authorities of the State where the rchitect wishes transfer until the required umber of references have been heard from.
6. Either at the time of sending the Appliation and Information Blanks to the appliant or at some time during the investigaion of his references he will be informed by he National Council as to the amount of his reliminary fee which he must pay to the tate examining authorities where he desires egistration and, upon receipt of this infornation, he will forward to the Council a ertified par value check covering the amount f that fee made out to the proper registration authorities of the State where he desires registration, as per instructions of the Council. This check will be held by the Council until applicant's record is finally completed, and will be forwarded to the State where he wishes registration along with the information collected concerning his record.

VII. Investigations By the Council.

In investigating the applicant's record, the Council takes his Information Blank and writes, first, to the registrars or principals of the schools where he has received his training, asking for a certified copy of his school record while in attendance upon these various institutions.

Second, it writes to the examining authorities of his home State for a certificate as to his registration in that State and inquiring as to whether charges have ever been preferred against him involving recklessness or carelessness in the design or supervision of buildings or dishonest practice.

Third, inquiry is made of his former employers, if he comes under the junior classification, concerning his record and promise as an architectural employee.

Fourth, inquiry is also made from at least three of his clients as to his competency and faithfulness in the execution of trusts imposed in him.

Fifth, inquiry is made of at least three architects as to their knowledge of the character and competency of his practice.

Sixth, inquiry is also made of professional and technical societies as to his membership and his record for honorable practice.

Seventh, when replies to these inquiries are received, they are carefully copied and certified to by the Executive Secretary of the Council and forwarded to the examining authorities where the architect desires registration.

VIII. Additional Transfers.

The originals are preserved in the Council office and become a part of the applicant's permanent record. Should he desire to transfer to additional States, he may have this transfer facilitated through the offices of the Council by applying for a transfer in the same manner as in the case of the original application, except enclosing a fee made payable ot the Council of only Five Dollars ($5.00). In such cases, the Council will simply send a duplicate copy of his record to the additional State where applicant desires registration, except in cases where a long time has elapsed between the original investigation and the time of application for an additional transfer. In such cases the Council will make further investigation to find out whether the applicant has continued to maintain the high standard indicated by the original investigation and will add the information thus obtained to the original record, proceeding otherwise as in the first case.

IX. Standard N. C. A. R. Examination.,

1. Should an applicant wish to take a Standard N. C. A. R. Examination he would proceed almost exactly in the same way as indicated in the foregoing upon making an application for reciprocal transfer, except that he shall include a fee of Twenty-five Dollars ($25.00) to the Council instead of Fifteen Dollars. The Council will proceed to investigate his record in exactly the same way as set forth for the investigation of record in the case of reciprocal transfer, with the following exception, that when the record is received and the copy made, the original replies and the original application blank will be bound up in an application cover, certified to and forwarded to the State examining authorities in the State of the applicant's residence, together with instructions to the State Examining Committee as to the additional examinations which the applicant must take over and above the regular State examination which he has already taken in order to qualify under the provision, "Registered by Standard N. C. A. R. Examination."

In due course, the applicant will be notified to appear before his own State Examining Committee and take the prescribed examination, which, if he passes creditably, will entitle him to the status, "Registered by Standard N. C. A. R. Examination," a status which would seem to entitle him to registration in any State without further examination and which would actually be the means of securing registration in most States having laws regulating the practice of architecture. It would mean that the applicant had the endorsement of the National Council of Architectural Registration Boards. The Council endorses no one and expresses no opinion whatsoever with reference to those who have not taken the Standard N. C. A. R. Examination. It simply collects the information and forwards it for the judgment of the local examining committee.

2. In the case of Junior Standard N. C. A. R. Examinations, reproductions of the applicant's work in design are made a part of the record of the National Council and furnished to the State of transfer with each application for reciprocal transfer.

3. In the case of Senior examinations, the applicant is required to furnish with his application for the Senior N. C. A. R. Examination eighteen illustrations, of reduced size, representative of the varying character of his work. These illustrations shall be presented either in the form of photographic film negatives with two prints of each or photostatic negatives and two prints of each. The sheets are to be the architectural standard size, 8½" x 11"; each containing six illustrations, making a total of eighteen, on three sheets.

4. In both Senior and Junior cases, the applicant must furnish a small identification photograph of himself which will be printed on one of the sheets illustrative of his work. Copies of these illustrations are furnished by the Council to the authorities in the State of examination and to all transfer state authorities along with a certified copy of the other records.

X. Concerning Fees.

The fees charged by the Council barely defray the expenses of its investigations. The Council is an institution organized "not for profit." All Council fees are in addition to State examining and registration fees. Should complaint be urged that the fees charged by the Council constitute an excessive burden on architectural practitioners who wish to engage in inter-state business, it should be pointed out that there is no requirement compelling architects to make use of the services of the Council. They are always at liberty to appear before the examining committee of the State where they wish to be registered by reciprocal transfer, submit their proofs, and receive registration or denial of registration in that State in accordance with the merits of their case. But it should be pointed out to the architects that most examining committees meet not more than twice a year and that many examining committees meet only once a year and that by mutual understanding registration by reciprocal transfer cannot except in very special cases be made between member States except on the basis of a Council investigation or by the personal appearance of the applicant before the local examining committee at one of its regular or special meetings. Transportation and hotel expense would very quickly mount up to a sum in excess of the nominal fees charged by the Council for its work; particularly when it is borne in mind that after the first investigation subsequent fees are only Five Dollars per transfer.

XI. Explanation and How to Avoid Delays.

The Council fully realized that often time is a very important consideration with the applicant for architectural registration or for reciprocal transfer of architectural registration, and it wishes to call architect's careful attention to some of the causes of delay and how delays may be avoided. To begin with, the applicant should appreciate the following facts:

1. Since Architectural Examining Boards, Commissions or Committees for the various states are made up of men in private practice who serve without remuneration or at the most with a small per diem remuneration plus an allowance for actual expenses, they cannot and do not meet more often than once or twice a year; hence, if an application reaches the Secretary of such a Committee just after a meeting, there may be a long delay before the application can be taken up for consideration.

2. No Examining Commission can give intelligent consideration to an application for the transfer of registration or to the registration of an architect engaged in practice in another state where there is no law regulating the practice of architecture without a careful independent investigation of the applicant's credentials and his record in practice for reasons hereinafter set forth.

Fraud is sometimes practiced by the unscrupulous, in consequence therof there is need of investigation in order to give protection to the public, also in justice to the honest majority of applicants, but the investigations conducted must be entirely independent of the applicant. In other words, diplomas, certificates, testimonial letters, etc., when submitted by the applicant may be and are in rare cases fraudulent. There have been cases where certificates of registration in other states have been fraudulently altered, the same is true with reference to school certificates, society memberships, and testimonial letters presented by applicants from architects and clients. There have been cases where certificates of registration of men long since dead have been used as a basis for reciprocal transfer by those fraudulently posing as the original registrants. For this reason, identification photographs are now being insisted upon by registration authorities in several of the states.

3. Independent investigations must be conducted largely by correspondence, often over long distances, in a considerable number of cases to foreign countries, thus necessarily consuming considerable time. The Council's experience in conducting these independent investigations, indicates that the average time is approximately six weeks, the minimum time is never less than four weeks, and the maximum time, three to six months, particularly in the case of foreign correspondence and where inaccurate addresses are given and in the case of absent correspondents delaying replies to inquiries.

4. The evil consequences incident to the long time required for investigations can be eliminated if architects will file applications with the Council for investigations of their record before they desire transfer to any state, have the investigation completed and placed on file with the Council, then if they suddenly wish transfer to a certain state the Council is in a position to immediately send a certified copy of an independent investigation of their record to the Examining authorities of the state where they desire transfer and this record will be in such shape that it may be passed from member to member of the local Examining Committee by means of registered mail, so that their decision may be secured by letter-ballot, thus avoiding the great loss of time incident to waiting for a stated meeting of an Examining Board. In this way, transfer has often been effected in time not to exceed two or three weeks. Wise men engaged in interstate business are taking this precaution and finding it advantageous. It should be universal practice.

STATES REQUIRING ARCHITECTURAL REGISTRATION

Information as to registration laws now in force in the following states may be obtained as follows

California—State Board of Architecture, Phelan Bldg., San Francisco. **Colorado**—State Board of Examiners of Architects, Denver. **Florida**—State Board of Architecture, 1355 East Bay Street, Jacksonville. **Georgia**—State Board for Registration of Architects, Atlanta. **Idaho**—Department of Law Enforcement, Boise. **Illinois**—Department of Education and Registration, Springfield. **Louisiana**—State Board of Architectural Examiners, New Orleans. **Michigan**—State Board for Registration of Architects, Detroit. **Minnesota**—State Board of Examiners, 804 Phoenix Bldg., Minneapolis. **Montana**—Board of Architectural Examiners, Helena. **New Jersey**—State Board of Architects, 665 Broad Street, Newark. **New York**—State Board for Registration of Architects, Albany. **North Carolina**—State Board of Architectural Examination and Registration, Greensboro. **North Dakota**—State Board of Architecture, Bismarck. **Oregon**—State Board of Architectural Examiners, Portland. **Pennsylvania**—State Board of Examiners of Architects, Harrisburg. **South Carolina**—State Board of Architectural Examiners, Columbia. **Tennessee**—State Board of Architectural and Engineering Examiners, Nashville. **Utah**—State Board of Architecture, Salt Lake City. **Virginia**—State Board for the Examination and Certification of Architects, Professional Engineers and Land Surveyors, Richmond. **Washington**—State Board for Registration of Architects, Olympia. **West Virginia**—State Board of Examiners and Registration of Architects, Odd Fellows Bldg., Charleston. **Wisconsin**—Board of Examiners of Architects, Madison. Such laws are pending in Indiana and Iowa.

REGISTRATION OF ARCHITECTS
STATE OF ILLINOIS

RULES AND REGULATIONS

General Statement

The Fifty-first General Assembly revised the law in relation to the regulation of the practice of architecture as a profession.

It is unlawful for any person to practice architecture or advertise or put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, wthout a certificate of registration as a registered architect duly issued by the Department of Registration and Education.

Any one, or any combination of the following practices constitutes the practice of architecture, namely: The planning or supervision of the erection, enlargement or alteration of any building or buildings or of any parts thereof, to be constructed for others. A building is any structure consisting of foundations, floors, walls, columns, girders, beams and roof, or a combination of any number of these parts, with or without other parts.

The professional features of the law are administered by a professional committee of architects, consisting of five persons, appointed from time to time by the Director of Registration and Education. The administrative provisions of the law are exercised by the Department of Registration and Education. The powers and duties of the professional committee are as follows:

1. To conduct examinations to ascertain the qualifications and fitness of applicants for registration, and pass upon the qualifications of applicants for reciprocal registration.

2. To prescribe rules and regulations for conducting examinations.

3. To decide the schools of architecture from which graduation will be accepted as the equivalent of two years of the prescribed office experience.

4. To conduct hearings on proceedings to revoke certificates of registration.

Applications

A person is qualified to receive a certificate of registration as a registered architect:

(a) Who is at least twenty-one years of age.

(b) Who has graduated from a high school or secondary school approved by the Department, or has completed an equivalent course of study as determined by an examination conducted by the Department, and has subsequently thereto completed such courses in mathematics, history and language as may be prescribed by the Department.

(c) Who has had at least three years' experience in the office or offices of a reputable architect or architects. A certificate of graduation from an approved school of architecture will be accepted as the equivalent of two years of the prescribed office experience; and

(d) Who has passed an examination conducted by the Department to determine his fitness to receive a certificate of registration as a registered architect.

Examinations

Examinations of applicants for certificates of registration as registered architects are held at such times and places as the Department of Registration and Education may determine, and embrace the following subjects:

1. The planning, designing and construction of buildings.

2. The strength of building materials.

3. The principles of sanitation and ventilation as applied to buildings.

4. The ability of the applicant to make practical application of his knowledge in the ordinary professional work of an architect and in the duties of a supervisor of mechanical work on buildings.

The Department of Registration and Education may, by rule, prescribe additional subjects for examination.

All examinations are conducted in the English language without the use of an interpreter, and are divided into six sections, A, B, C, D, E and F.

Examination A—The Science of Planning and the Art of Designing Buildings. This examination is held the first day with a time allowance of eight hours continuous session, consisting:

First—Of a test in the science of planning, particularly with reference to practical, logical and economical arrangement; the securing of comfort and the safeguarding of life and health of the proposed occupants of the building. (Grade value 100.)

Second—Of a test in the art of designing, particularly with reference to orderly and consistent expression of purpose, logical meeting of conditions and pleasing harmonious presentation. It is not a test in a knowledge of historical styles. The grades will be based solely on the degree of perfection in meeting the before mentioned elemental requirements of good design. (Grade value 100.)

The test under "A" problem requires plans, elevations, sections and some detail drawings for a building the nature of which will be set forth in a program such as a well informed owner might be expected to give to an architect.

Time—8:30 A. M. to 4:30 P. M. en loge.

No reference books will be permitted.

Examination B—Graphic Statics and Truss Design. This examination is held the morning of the second day with a time allowance of two and one-half hours continuous session. It consists of a test in the science of graphic statics as applied to a truss problem, assuming that the preliminary designs of a building are complete, loads determined and diagram of truss settled upon. The candidate is required to determine the maximum stress in each member and its section, and to detail one or more designated joints. (Grade value 100.)

Time—8:30 A. M. to 11:00 A. M.

Free use of reference books is permitted.

Examination C—General Details. This examination is held the morning of the second day with a time allowance of one and one-half hours, consisting of a test in the knowledge of principles general detailing as shown by scale and full size details of such parts of buildings as are encountered in the usual practice of an architect. (Grade value 100.) One-half of the grade will be based on Examination C and the other half on the knowledge of detailing indicated by the other examinations.

Time—11:00 A. M. to 12:30 P. M.

No reference books or plates may be used.

Examination D—Specifications, Practice and Precedent. This examination is held the afternoon of the second day with a time allowance of three and one-half hours continuous session, consisting:

First—Of a test in the knowledge of specification writing, knowledge of the essence of the contract and of general architectural practice, as it pertains to relationship between the public, the owner, the contractor and the architect. (Grade value 80.)

Second—Of a test of general knowledge of the history of architecture and its place in social economy. (Grade value 20.)

Time—1:30 P. M. to 5:00 P. M.

No reference books may be used.

Examination E—Mechanics of Materials. This examination is held the morning of the third day, with a time allowance of four hours continuous session, consisting of a test in the sciene of determining the strength of materials and the applicant's knowledge of applied mechanics. The test requires the applicant to design the various parts of a structure and show ability to determine the safe, practical working sizes and shapes of footings, piers, columns, beams, girders and floors. Sketches will be furnished the applicant showing conditions and loading. (Grade value 100.)

Time—8:30 A. M. to 12:30 P. M.

Free use of reference books is permitted.

Examination F—Reinforced Concrete Design. This examination is held the afternoon of the third day, with a time allowance of three and one-half hours' continuous session, consisting of a test in the science of computing stresses in reinforced concrete structures and involving exercises to show the applicant's knowledge of the correct design and detailing of reinforced concrete structural parts, such as footings, columns, girders, beams and floor slabs, assuming that the preliminary designs of the building are complete, loads determined, story heights and column spacing fixed. The candidate is required to compute stresses and detail parts which are safe, practical and economical for the purposes intended. (Grade value 100.)

Time—1:30 P. M. to 5.00 P. M.

Free use of reference books is permitted.

Grading of Examination Papers

Examination papers are graded as follows:

The maximum allowed on Examination A is 200; on Examinations B, C, D, E, and F, 100 each. The grade given the applicant on the whole examination is obtained by dividing the total A, B, C, D, E, and F by seven.

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To be successful, an applicant must make a general average of 75 with no grade in any subject below 60. If an applicant fails in his first examination, he will be permitted, upon the payment of a second examination fee, to take a second examination in those subjects in which he fell below 75 at any regular examination within eighteen months from the date of the first examination. If the applicant fails in his second examination and desires to appear for a third, it will be necessary for him to file another examination fee and be examined in ALL subjects.

Reciprocity

Upon payment of the required fee, an applicant who is an architect, registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, may, without examination, be granted a certificate of registration as a registered architect by the Department of Registration and Education in its discretion upon the following conditions:

(a) That the applicant is at least twenty-one years of age, of good moral character and temperate habits;

(b) That the requirements for the registration or licensing of architects in the particular state, territory, country or province were, at the date of the license, substantially equal to the requirements then in force in this State; and,

(c) That the applicant appears before the committee at one of its regular meetings with exhibits of his work.

Annual Renewal

Every registered architect who continues in active practice, shall annually, on or before the first day of July, renew his certificate of registration and pay the required renewal fee. Every license or certificate of registration which has not been renewed during the month of July in any year, shall expire on the first day of August in that year. A registered architect whose certificate of registration has expired may have his certificate restored only upon the payment of the required restoration fee.

Any architect registered or licensed in this State who has retired from the practice of architecture for a period of not more than five years, may have his certificate of registration renewed at any time within a period of five years after so retiring, upon making application to the Department for such renewal and upon payment of all lapsed renewal fees.

Fees

The fee to be paid by any applicant for an examination to determine his fitness to receive a certificate of registration as a registered architect is ten ($10.00) dollars.

The fee to be paid by any applicant for a certificate of registration as a registered architect is five ($5.00) dollars.

The fee to be paid for the restoration of an expired certificate of registration is five ($5.00) dollars.

The fee to be paid upon renewal of a certificate of registration is one ($1.00) dollar.

The fee to be paid by an applicant for a certificate of registration who is an architect registered or licensed under the laws of another state or territory of the United States, or of a foreign country or province, is fifteen ($15.00) dollars.

Seal

Every registered architect shall have a seal, the impression of which shall contain the name of the architect and the words "Registered Architect, State of Illinois." He shall stamp with this seal all working drawings and specifications prepared by him or under his supervision.

Instruction to Candidates

All candidates must appear at 8:00 A. M. on the days set for the examination at the place designated on their admission cards. They must bring all necessary drawing instruments, a 36-in. T-square triangle, scales, thumb tacks, etc., for examinations A, B, and C. For examinations D, E, and F, scales and triangles alone will be sufficient. The use of slide rules for mathematical calculations is permitted, but special slide rules for concrete and steel design are not to be used.

For the first day's work, applicants must bring six sheets of medium weight tracing paper 20 by 30 inches, and one sheet of heavy detail paper 24 by 36 inches. Candidates will not be allowed to leave the room on the first day, but may bring lunch.

For examinations B and C, applicants must bring three sheets of heavy tracing paper.

The paper for other examinations will be furnished by the Department.

Penalties

Each of the following acts constitutes a misdemeanor punishable upon conviction by a fine of not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00) for each offense:

(a) The practice of architecture by any person or the advertising or putting out of any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect, without a certificate of registration as a registered architect issued by the Department of Registration and Education.

(b) The making of any wilfully false oath or affirmation in any matter or proceedings where an oath or affirmation is required by this Act.

(c) The affixing of a registered architect's seal to any plans, specifications or drawings, which have not been prepared by him or under his immediate personal supervision.

(d) Neglect or failure of the holder o a certificate of registration to display it i a conspicuous place in his principal office, place of business, or place of employment.

(e) Neglect or failure of a holder of a certificate of registration to stamp with hi seal all working drawings and specifications prepared by him or under his supervision.

All fines and penalties shall inure to the Department of Registration and Education.

Suspensions—Revocations

The Department of Registration and Education may refuse to renew, or may suspend, or may revoke, any certificate of registration for any one or any combination of the following cases:

(a) Gross incompetency.

(b) Recklessness in the construction of buildings or their appurtenances.

(c) Dishonest practice.

(d) When the architect has been twice convicted for a violation of any of the provisions of this Act.

(e) A person who has by false or fraudulent representation obtained or sought to obtain a certificate of registration as an architect.

All correspondence in regard to applications, examinations, etc., should be addressed to the Department of Registration and Education, Springfield, Illinois.

Published by order of

DEPARTMENT OF REGISTRATION AND EDUCATION:

ADDISON M. SHELTON,
Director.

V. C. MICHAEL,
Superintendent of Registration.

OLD AND NEW WAGES IN BUILDING TRADES

The following list is a tabulated comparison of the wage scale in the building trades, showing the effect of the decision of Judge Landis:

	New scale. per hour.	Old scale. per hour.
Plumbers	$ .95	$1.25
Bricklayers	1.10	1.25
Boilermakers	1.00	1.25
Steamfitters	.95	1.25
Hoisting engineers—For operation of high pressure boilers and engines, cable ways, derricks, pile drivers, cranes and cable hoists	1.10	1.25
Hoisting engineers (all others)	.85	1.25
Tile layers (fire-proofers)	1.12½	1.25
Cement finishers	.85	1.25
Composition floor finishers	.97½	1.25
Cement workers (laborers—Local No. 76)	.72½	1.00
Stone derrickmen	.90	1.25
Drain layers	.82½	1.25
Electricians	1.10	1.25
Gas fitters	.95	1.25
Ornamental iron workers	.95	1.25
Structural iron workers	1.05	1.25
Common laborers	.72½	1.00
Caisson men (windlass and niggerhead men)	.85	1.12½
Caisson men (diggers and laggers)	.97½	1.25
Laborers (plasterers)	.78¾	1.06¼
***Excavating labor (Local No. 225)**	.47½	.65
***Excavating labor (wall men—Local No. 225)**	.55	.75
Composition floor laborers	.78¾	1.00
Lathers	1.00	1.25
Machinery movers and riggers	.92½	1.15
Marble setters	.97½	1.25
Marble setters' helpers	.70	1.00
Marble rubbers and polishers	.75	1.00
Scagliola rubbers and polishers	.80	1.00
Mosaic and tile workers	1.02½	1.25
Mosaic and tile helpers	.70	1.00
Pipe and boiler coverers	.95	1.25
Composition roofers	.92½	1.25
Slate and tile roofers	1.00	1.25
Stone cutters	1.02½	1.25
Stone carvers	1.25	1.25
Stone planer men	.82½	1.05
Terrazzo mechanics	.95	1.25
Terrazzo mechanics' assistants	.82½	1.00
Terrazzo mechanics helpers	.70	1.00
Tuck pointers	1.00	1.25
Sprinkler fitters	.92½	1.25
Sprinkler fitters' helpers	.70	1.00
Composition roofer teamsters	30.00 per wk.	37.00

The following trades were in the arbitration but for one cause or another did not submit acceptable agreements. The Arbiter announced "That if agreements are later made, based upon the Uniform Agreement, the Uniform Suggestions and Principles previously announced that a fair wage rate for these trades would not be greater than the following:

Elevator Constructors	$0.95	**Glaziers**	$0.95
Fixture Hangers	1.00	**Sheet Metal Workers**	.95

And that for the three trades not in the arbitration, equally fair working agreements and rules would justify the following maximum wage rates:

Carpenters	$1.00	**Painters**	$0.95	**Plasterers**	$1.10

(*These rates are fixed in accordance with express agreement with employer and employes.)

CITY HALL AND COUNTY BUILDING INFORMATION AND GUIDE.

TAXES: When and Where to Pay.

GENERAL TAXES: State, County and City.

Annually at **County Treasurer's Office,** County Building, 1st floor, north end. Must be paid before May 1 of each year. Failure to pay before May 1 means a penalty of one (1%) per cent per month until sold. (Then heavier penalty; and trouble.)

SPECIAL ASSESSMENTS: (Street Paving, Water Pipes, etc.)

Payable before July 1 at City Collector's Office, City Hall, first floor, south end.

Payable on and after August 1 at County Treasurer's Office, County Building, first floor, north end.

WATER TAX:

At Bureau of Water, City Hall, 1st floor, north end.

DOG TAX:

City Clerk, 1st floor, south end.

OFFICES—CITY HALL.

Ambulance Service, Bureau of, vault floor, south end.

Architect, City, 10th floor, south end.

Board of Election Commissioners, 3rd floor, south end.

Board of Examiners:

- Motor Vehicle Operators, 180 N. LaSalle St.
- Moving Picture Operators, 6th floor, south end.
- Plumbers, 10th floor, south end.
- Stationary Engineers, 10th floor, south end.

Board of Inspectors of Public Vehicles, 3rd floor, 180 N. LaSalle St.

Board of Local Improvements:

- General Offices, 2nd floor, south end.
- Public Hearing Room, 1st floor, north end.
- Law Department, 2nd floor, south end.

Boiler Inspection, 601 City Hall.

Buildings, Department of, 7th floor, north end.

Bridge Division, 4th floor, north end.

Business Agent, vault floor, north end.

City Attorney, 6th floor, north end.

City Clerk, 1st floor, south end.

City Collector, 1st floor, south end.

City Comptroller (5th floor, north end):

- General Office.
- Auditor.
- Paymaster.
- Real Estate Agent.

City Council:

- Council Chamber, 2nd floor, north end.
- General Committee Rooms, 2nd floor, north end.
- Committee on Finance, 3rd floor, north end.
- Committee on Local Transportation, 2nd floor, north end.

City Electrician, 6th floor, south end.

City Forester, 10th floor, north end.

City Hall:

- Engineer, basement, south end.
- Chief Janitor, basement.

City Sealer, 608 City Hall, south end.

City Statistician, 10th floor, north end.

City Treasurer, 2nd floor, center.

Civil Service Commission:

- General Offices, 6th floor, south end.
- Examining Room, 10th floor, center.

Compensation, Bureau of, vault floor, south end.

Corporation Counsel, 5th floor, south end.

Dog Pound, W. 29th St. and S. Sacramento Ave.

Education, Board of, 646 So. Clark St.

Engineering, Bureau of (City Engineer), 4th floor, north end.

Election Commissioners, Board of, 3rd floor, center.

Electricity, Department of, 6th floor, south end.

Electrical Supervisor, R. 613, south end.

Fire Department:

- Fire Marshal, 1st floor, north end.
- Fire Alarm Telegraph, 6th floor, center.
- Firemen's Pension Fund, Secretary of Board of Trustees (City Clerk), 1st floor, south end.
- Department Attorney, 1st floor, south end.

Fire Prevention & Public Safety, Bureau of, 6th floor, north end.

Gas & Electricity, Dept. of, R. 614, center.

Gas, Oil & Electric Light, Committee on, 2nd floor, north end.

Gas Supervisor, 6th floor, south end.

Harbor Board, R. 406, south end.

Harbor Division, 4th floor, north end.

Health, Department of, 7th floor.

- Commissioner of Health.
- Bureau of Food Inspection.
- Bureau of Sanitary Inspection.
- Bureau of Contagious Diseases.
- Bureau of Vital Statistics.

High Cost of Living Commission, R. 1003, north end.

House of Correction, W. 26th St. and S. California Ave.

Laboratory, Health Department, R. 713, south end.

Law, Department of:

- Corporation Counsel, 5th floor, south end.
- City Attorney, 6th floor, north end.
- Prosecuting Attorney, 6th floor, north end.
- Special Assessment Attorney, 2nd floor, south end.

Library, Chicago Public, N. Michigan Ave. and E. Washington St.

Library, Municipal Reference, 10th floor, north end.

Local Transportation, Committee on, 2nd floor, north end.

Maps and Plats, Bureau of, 4th floor, south end.

Mason Contractors, Board of Examiners of, R. 1008, south end.

Mayor's Office, 5th floor, center.

Morals Commission, R. 710, south end.

Motor Vehicle Operators, Board of Examiners, 180 N. La Salle St.

Moving Picture Operators, Board of Examiners, 6th floor, south end.

Municipal Court:

- Chief Justice, 9th floor, south end.
- Bailiff, 8th floor, north end.
- Clerk, 8th floor, south end.
- Court Rooms, 8th, 9th and 11th floors.

Municipal Lodging House, 162 N. Union Ave.
Municipal Pension Fund, R. 1005, north end.
Municipal Pier, foot of East Grand Ave.
Municipal Reference Library, 10th floor, north end.
Oils, Inspector of, 10th floor, south end.
Parks, Playgrounds & Bathing Beaches, Bureau of, 10th floor, north end.
Physician, City, 2100 W. Chicago Ave.
Plan Commission, Chicago, Hotel Sherman.
Police Department:
- General Superintendent, 5th floor, north end.
- Assistant General Superintendent, 3rd floor, north end.

Police Pension Fund, 10th floor, north end.
Plumbers, Board of Examiners of, 10th floor, south end.
Prosecuting Attorney, 6th floor, north end.
Public Service, Dept. of, R. 613, south end.
Public Welfare, Dept of, 139 N. Clark St.
Public Works:
- Commissioner, 4th floor, center.
- Bureau of Engineering, 4th floor, north end.
- Bridge Division, 4th floor, north end.
- Harbor Division, 4th floor, north end.
- Bureau of Maps and Plats, 4th floor, south end.
- Bureau of Sewers, 4th floor, south end.
- Bureau of Streets, 4th floor, south end.
- Bureau of Water, 1st floor, north end.
- Water Pipe Extension Division, 4th floor, north end.

Railway Terminal Commission, 140 N. Dearborn St.
Sanitary Inspection, Bureau of, 7th floor, north end.
Schools, Supt. of, 646 S. Clark St.
Sewers, Bureau of, 4th floor, south end.
Smoke Inspection, Bureau of, R. 704, 7th floor.
Special Assessments (Board of Local Improvements), 2nd floor, south end.
Special Assessments (Law Department), 2nd floor, south end.
Stationary Engineers, Board of Examiners of, 10th floor, south end.
Statistician, City, 10th floor, north end.
Steam Boilers and Steam Plants, Department of Inspection of, 1st floor, Washington St. entrance.
Streets, Bureau of, 4th floor, south end.
Supervising Engineers, Board of, 105 S. La Salle St.
Supplies, Department of (Business Agent), vault floor, north end.
Telephone Supervisor, R. 613, south end.
Transportation Supervisor, R. 613, south end.
Treasurer, City, 2nd floor, center.
Tuberculosis Sanitarium, Municipal, 105 W. Monroe St.
Vehicles, Board of Inspectors of, 180 N. La Salle St., 3rd floor.
Waste Disposal, Bureau of, W. Pershing Rd. and Iron St.
Water, Bureau of, 1st floor, north end.
Water Pipe Extension Division, 4th floor, north end.
Weights and Measures, Department of, 6th floor, south end.

OFFICES—COUNTY BUILDING.

APPELLATE COURT, CLERK OF:

R. 1400 Michigan Blvd. Bldg.

BOARD OF ASSESSORS:

Members of the Board:

Charles Ringer,
Wm. H. Weber,
Adam Wolf,
George K. Schmidt,
Charles Krutckoff.

Chief Clerk:

Paul H. Wiedel,
R. 312, 3rd floor.

BOARD OF REVIEW:

Members of Board:

Edward R. Litsinger,
P. A. Nash,
Charles V. Barrett.

Chief Clerk:

Stephen D. Griffin.
R. 337, 3rd floor.

CIRCUIT COURT:

Clerk:

August W. Miller.
R. 412, 4th floor.

Judges:

Hon. Victor P. Arnold,
Hon. John R. Caverly,
Hon. David M. Brothers.
Hon. Harry M. Fisher,
Hon. Hugo M. Friend,
Hon. Frank Johnston, Jr.,
Hon. George Kersten,
Hon. Thomas J. Lynch,
Hon. David F. Matchett,
Hon. Donald L. Morrill,
Hon. George Fred Rush.
Hon. Ira Ryner,
Hon. Kickham Scanlan,
Hon. Philip L. Sullivan,
Hon. John A. Swanson,
Hon. Thomas Taylor, Jr.,
Hon. Charles M. Thomson,
Hon. Oscar M. Torrison,
Hon. Francis S. Wilson,
Hon. Thomas G. Windes.

CIVIL SERVICE COMMISSION:

Harry A. Lipsky.
James M. Whalen, Secretary
W. B. Willard.
R. 547, 5th floor.

CLERK, COUNTY:

Robert M. Sweitzer.
R. 233, 2nd floor.

COMPTROLLER, DEPUTY COUNTY:

William J. Graham.
R. 511, 5th floor.

CORONER:

Peter M. Hoffman.
R. 500, 5th floor.

COUNTY AGENT:

Wm. H. Eheman
1906 W. Polk St.

COUNTY CLERK:

Robert M. Sweitzer.
R. 233, 2nd floor.

COUNTY COMMISSIONERS, BOARD OF:

Daniel Ryan, President.

Commissioners, City Districts:

Charles N. Goodnow,
Robert W. McKinlay,
Frank J. Wilson,
Emmett Whealan,
Joseph M. Fitzgerald,
Bartley Burg,
Daniel Ryan,
Thos. Murray,
Mrs. E. W. Bemis

Country Districts:

William Busse,
Frederick W. Penfield,
Dudley D. Pierson,
George A. Miller,
William H. McLean.

Committee Clerk:

Peter J. Ellert.
R. 507.

COUNTY COURT:

Frank S. Righeimer, Judge.
R. 602, 6th floor.
Robert M. Sweitzer, Clerk.
R. 600, 6th floor.

COUNTY HOSPITAL:

Michael Zimmer, Warden.
Harrison and Wood Sts.

COUNTY SUPERINTENDENT OF SCHOOLS:

Edward J. Tobin.
R. 1122, 11th floor.

COUNTY TREASURER:

Patrick J. Carr.
Office, R. 212, 2nd floor
General Office, 1st floor, north end.

CUSTODIAN, COUNTY BUILDING:

Albert F. Peters.
R. 1026, 10th floor.

FOREST PRESERVE COMMISSIONERS, BOARD OF:

R. 547, 5th floor.

HIGHWAYS, SUPERINTENDENT OF:

Geo. A. Quinlan,
R. 1126, 11th floor.

JURY COMMISSIONERS:

Joseph H. Barnett.
Frank X. Rydzewski.
E. J. Mullaney
Martin Peterson, Clerk
R. 824, 8th floor.

JUVENILE COURT:

Hon. Victor P. Arnold, Judge.
9th floor.

MORGUE, COUNTY:

Harrison and Wood Sts.

OAK FOREST INFIRMARY:

H. L. Bailey, Superintendent.
Oak Forest, Illinois.

PROBATE COURT:

Hon. Henry Horner, Judge
R. 643, 6th floor.
John F. Devine, Clerk.
R. 623, 6th floor.

RECORDER OF DEEDS:

Joseph F. Haas.
1st floor, south end

REGISTRAR OF TITLES (Torrens System):

REVIEW, BOARD OF:

R. 337, 3rd floor.

SHERIFF:

Chas. W. Peters.
R. 423, 4th floor.

SOCIAL SERVICE, BUREAU OF:

Miss Katherine Meade, Superintendent.
R. 1130, 11th floor.

STATE'S ATTORNEY:

Robert E. Crowe.
Austin and Dearborn Aves.

SUPERIOR COURT:

Judges:

Hon. Albert C. Barnes,
Hon. Harry B. Miller,
Hon. Timothy D. Hurley,
Hon. Joseph B. David,
Hon. William E. Dever,
Hon. Joseph H. Fitch,
Hon. Charles M. Foell,
Hon. Martin B. Gridley,
Hon. Harry A. Lewis,
Hon. Jacob H. Hopkins,
Hon. Oscar Hebel,
Hon. Joseph Sabath,
Hon. Marcus A. Kavanagh,
Hon. Charles A. MacDonald,
Hon. M. L. McKinley,
Hon. Hugo Pam,
Hon. Denis E. Sullivan,
Hon. John J. Sullivan,
Hon. William H. McSurely,
Hon John M. O'Connor.

Clerk:

Samuel E. Erickson.
R. 437, 4th floor.

SUPERINTENDENT OF PUBLIC SERVICE:

Henry A. Zender.
R. 519, 5th floor.

SURVEYOR:

Ben H. Suhr.
R. 726, 7th floor.

TAX EXTENSION DEPARTMENT:

M. J. O'Brien, Chief
R. 217, 2nd floor.

TORRENS SYSTEM:

Joseph F. Haas, Registrar
1st floor, south end

COUNTY ARCHITECT:

Erick E. Hall
123 W. Madison St

CLERK OF CRIMINAL COURT:

John P. Gibbons.
Austin and Dearborn Aves

Born Building, Harrison & Wells Sts., Chicago
Alfred S. Alschuler, Architect — Flat Slab Concrete Construction

Rosenwald & Weil Bldg., 600′x267′ Mill Construction, 3500-3825 Armitage Ave., Chicago
Alfred S. Alschuler, Architect

CITY OFFICIALS

WM. HALE THOMPSON	Mayor.
JOHN M. KELLY	Secretary to the Mayor
HUGH NORRIS	Oil Inspector.
WM. STOCKER	City Sealer.
GEORGE F. HARDING	City Comptroller.
LOUIS E. GOSSELIN	Deputy City Comptroller.
CHARLES R. FRANCIS	Commissioner of Public Works.
CLAYTON F. SMITH	City Treasurer.
JAMES T. IGOE	City Clerk.
EDWARD J. PADDEN	Chief Clerk, City Clerk's Office.
J. WYATT McGAFFEY	Reading Clerk, City Council.
GEORGE E. CARLSON	City Electrician.
JAMES REA	Department of Supplies.
AGE ZYLSTRA	City Collector.
ALEXANDER RAMSAY	Deputy City Collector.
HERMAN N. BUNDESON	Health Department.
DR. GOTTFRIED KOEHLER	Asst. Comr. of Health.
DR. HERMAN SPAULDING	Chief Medical Inspector.
THOS. H. BYRNE	Superintendent of Streets.
JOS. P. GEARY CHAS. E. FRAZIER CARLOS AMES	Civil Service Commission.
HARRY E. WALLACE	Secretary, Civil Service Commission.
CHAS. BOSTROM	Building Commissioner.
ROBERT KNIGHT	Chief Deputy, Building Commissioner.
CHAS. C. FITZMORRIS	Chief of Police.
JOHN H. ALCOCK	1st Deputy Sup't of Police.
PHILIP R. CRIPPEN	Department Inspector.
SAMUEL A. ETTELSON	Corporation Counsel.
WM. H. DEVENISH	City Attorney.
LOUIS P. PIQUETT	City Prosecutor.
JOHN D. RILEY	Map Department.
DR. W. J. POLLOCK	City Physician.
WILLIAM J. McCOURT	Superintendent, Bureau of Water.
WM. H. REID	Comr. of Public Service.
EDW. F. MOORE, 2nd Vice Pres. PHILIP M. GIESELER, Pres. FRANK A. WEST, 1st Vice Pres.	Board of Examining Engineers.
MICHAEL HUGHES	Chief Detective Bureau.
GEO. E. NYE	Inspector of Steam Boilers and Steam Plants
N. E. MURRAY	Superintendent of Sidewalks.
DR. E. V. HILL	Chief of Sanitary Bureau.
EDWARD PRITCHARD	Secretary, Health Department.
SIMON MAYER	Secretary of Police.
ALEXANDER MURDOCH	City Engineer.
M. J. FAHERTY (Prest.) DAVID W. CLARK WM. F. FINECUANE MRS. IRENE MONTONYA LEONARD WITHALL	Board of Local Improvements.
EDWARD J. GLACKIN	Secretary of Board of Local Improvements.
THOS. O'CONNOR	Fire Marshal.
GEO. E. McGRATH	Supt. of Sewers.
FREDERICK REX	Municipal Reference Librarian.
JOS. B. McDONOUGH	Chairman, Special Park Commission.
H. J. HAENISCH	Supt. Bureau of Compensation.
JOS. SIMAN	Supt. House of Correction.
CHARLES W. KALLAL	City Architect.
LOUISE O. ROWE	Supt. of Public Welfare.
CHARLES TODD WM. W. PETRIE (Journeyman)	Board of Examining Plumbers.
CHAS. STEWART (Member) WM. P. CROWE, Chairman	Board of Examining Mason Contractors.

The Federal Reserve Bank B'ldg., Chicago — Graham, Anderson, Probst & White, Archts., Chicago

John Griffiths & Son Co.

BUILDERS

CHICAGO

THE CITY COUNCIL, CHICAGO

WILLIAM HALE THOMPSON, Mayor

JAMES T. IGOE, City Clerk — **EDWARD J. PADDEN, Chief Clerk**

1ST WARD	MICHAEL KENNA, D., 311 S. Clark st	Har. 872
	JOHN J. COUGHLIN, 311 S. Clark st	Har. 0872
2ND WARD	LOUIS B. ANDERSON, R, 508, 184 W. Washington st	Frank. 2717
	ROBERT R. JACKSON, R, 3300 S. State st	Douglas 2344
3RD WARD	JOHN H. JOHNTRY, 4503 Oakenwald av	Kenwood 8045
	U. S. SCHWARTZ, D, 906, 6 N. Clark St	Frank 0640
4TH WARD	TIMOTHY A. HOGAN, D, 3038 Throop st	Drover 9155
	JOHN A. RICHERT, D, 2603 S. Halsted st	Yards 1148
5TH WARD	JOS. B. McDONOUGH, D, 538 W. 37th st	Yards 1951
	ROBERT J. MULCAHY, D, 3367 Archer av	Lafayette 3869
6TH WARD	CHARLES S. EATON, R, 500, 35 N. Dearborn st	Rand. 0281
7TH WARD	GUY GUERNSEY, R, 1515 Harris Trust bldg	Rand. 0901
8TH WARD	ROSS A. WOODHULL, D, 9117 Commercial av	S. Chgo. 1800
	MARTIN S. FURMAN, D, 8745 Commercial av	S. Chgo. 0296
9TH WARD	GUY MADDEROM, R, 11030 S. Michigan Av	Pull. 0264
	SHELDON W. GOVIER, D, 11350 Forrestville av	Pull. 1991
10TH WARD	JAMES McNICHOLS, D, 1322 Washburne av	Canal 2866
11TH WARD	DENNIS A. HORAN, 1914 S. Ashland av	Canal 4555
	LEONARD RUTKOWSKI, 1727 W. 18th st	Canal 0864
12TH WARD	ANTON J. CERMAK, D, 3347 W. 26th st	Lawndale 3200
	JOSEPH CEPAK, 2604 W. 21st Pl	Rockwell 0759
13TH WARD	SAMUEL O. SHAFFER, R, 3916 W. Van Buren St	Cent. 6442
	JOHN G. HORNE, D, 129 S. Central Park Blvd	Kedzie 3370
14TH WARD	GEO. M. MAYPOLE, D, 3523 Fulton st	Nevada 9128
	JOSEPH H. SMITH, D, 2342 W. Superior st	Seeley 0135
15TH WARD	EDWARD J. KAINDL, D, 2600 W. Chicago av	Humb. 5684
	OSCAR H. OLSEN, R, 1905, 139 N. Clark st	Cent. 1625
16TH WARD	JOHN CZEKALA, 1839 Evergreen av	Humb. 6678
	JOHN A. PIOTROWSKI, D, 1459 Blackhawk st	Monroe 0342
17TH WARD	THOMAS P. DEVEREUX, 751 N. Racine av	Mon. 0085
	S. S. WALKOWIAK, D, 1317, 139 N. Clark st	Rand. 3564
18TH WARD	JOHN J. TOUHY, D, 1339 W. Adams st	Haymarket 2629
	MAURICE F. KAVANAGH, D, 666 W. Madison st	Mon. 6130
19TH WARD	JOHN POWERS, D, 1284 Macalister pl	Mon. 1215
	JAMES B. BOWLER, D, 631 S. Ashland av	Monroe 4943
20TH WARD	HENRY L. FICK, D, 559 W. Roosevelt rd	Canal 0584
	MATT. FRANZ, D, 1700 S. Halsted st	Canal 3046
21ST WARD	DORSEY R. CROWE, D, 755 N. Dearborn st	Sup. 8843
	CHARLES J. AGNEW, 40 E. Elm st	Sup. 1452
22ND WARD	ARTHUR F. ALBERT, 1700 N. Halsted st	Lincoln 8545
	LEO C. KLEIN, 1426 Mohawk st	Diversey 8071
23RD WARD	THOS. O. WALLACE, R, 846 Center st	Lincoln 0705
	WALTER P. STEFFEN, R, 545 Belmont Ave	Wellington 7140
24TH WARD	LEO M. BRIESKE, 3037 Lincoln ave	Graceland 0081
	JOHN HADERLIN, D, 1917 Barry av	Wellington 8963
25TH WARD	E. I. FRANKHAUSER, 522, 38 S. Dearborn st	Dearborn 1636
	FRANK J. LINK, R, 430 Orleans st	Main 1026
26TH WARD	CHARLES G. HENDRICKS, 1201-69 W. Washington st	Randolph 0440
	THOS. R. CASPERS, 1770 Cullom av	Wellington 5125
27TH WARD	EDWARD R. ARMITAGE, R, 5826 Berenice ave	Kildare 4530
	CHRIST A. JENSEN, 4226 N. Sawyer av	Juniper 1028
28TH WARD	HENRY SCHLEGEL, 2930 Lyndale st	Armitage 750
	MAX ADAMOWSKI, D, 2812 Fullerton av	Armitage 0300
29TH WARD	JAMES F. KOVARIK, D, 5022 S. Marshfield av	Repub. 0322
	THOMAS F. BYRNE, D, 6743 S. Irving av	Prospect 1259
30TH WARD	WM. J. LYNCH, 509 W. 43rd pl	Yards 3510
	WM. R. O'TOOLE, D, 1048 W. 55th st	Boulevard 0180
31St WARD	SCOTT M. HOGAN, R, 912 Ashland blk	Rand. 0649
	TERRANCE F. MORAN, D, 5634 S. Ada st	Englewood 6593
32ND WARD	BENJAMIN S. WILSON, 7240 Yale ave	Stewart 2028
	JOHN H. LYLE, R, 300-4, 108 S. La Salle st	Main 0935
33RD WARD	JOHN P. GARNER, R, 5615 W. Lake st	Austin 1756
	ALBERT O. ANDERSON, R, 4346 Fullerton av	Belmont 0078
34TH WARD	JOS. O. KOSTNER, 402 Ashland blk	State 6060
	JOHN TOMAN, D, 4141 W. 21st pl	Lawndale 4986
35TH WARD	JOHN S. CLARK, D, 4259 W. North av	Belmont 8810

(Continued on Page 129)

Warehouses for Griswold & Walker Co., extending from Morgan St. to Peoria St., between the B. & O. R. R. and N. W. R. R. tracks at 15th St.
A. S. Alschuler, Architect, Steger Bldg., Chicago

STANDING COMMITTEES

1921-22

WILLIAM F. HARRAH, Sergeant-at-Arms. Residence Phone, Lake View 9609.

THOMAS J. COURTNEY, Asst. Sergeant-at-Arms.

JOHN TWOHIG, Asst. Sergeant-at-Arms.

HENRY SONNENSCHEIN, Asst. Sergeant-at-Arms.

JOHN DOHNEY, Asst. Sergeant-at-Arms.

Finance. Meets on Fridays at 1:00 P. M.—RICHERT, L. B. Anderson, Schwartz, Guernsey, Woodhull, Cermak, Maypole, Powers, Crowe, Steffen, Armitage, Adamowski, Moran, Lyle, A. O. Anderson, Garner, Kostner, Clark.

Local Transportation. Meets on Thursdays at 2:30 P. M.—SCHWARTZ, L. B. Anderson, T. A. Hogan, Mulcahy, Guernsey, Madderom, Shaffer, Smith, Olsen, Walkowiak, Bowler, Franz, Wallace, Link, Jensen, Byrne, W. J. Lynch, Garner, Toman.

Railroads, Industries and Compensation. Meets on Tuesdays at 2:30 P. M.—CERMAK, L. B. Anderson, Schwartz, McDonough, Eaton, Guernsey, McNichols, Horan, Horne, Smith, Olsen, Walkowiak, Touhy, Bowler, Franz, Wallace, Haderlein, Link, Caspers, Armitage, Byrne, O'Toole, S. M. Hogan, Kostner, Clark.

Gas, Oil and Electric Light. Meets on Fridays at 2:30 P. M.—BOWLER, Jackson, T. A. Hogan, Furman, Madderom, McNichols, Horan, Cepak, Horne, Kaindl, Walkowiak, Bowler, Haderlein, Link, Armitage, Adamowski, O'Toole, Moran, Toman.

Judiciary. Meets on Mondays at 2:00 P. M.—OLSEN, Coughlin, Jackson, Schwartz, T. A. Hogan, Guernsey, Woodhull, Govier, Rutkowski, Maypole, Walkowiak, Powers, Agnew, Steffen, Brieske, Frankhauser, S. M. Hogan, Lyle, A. O. Anderson.

Buildings and Zoning. Meets on Tuesdays at 10:30 A. M.—O'TOOLE, Jackson, Johntry, T. A. Hogan, Mulcahy, Madderom, McNichols, Cepak, Shaffer, Smith, Kaindl, Piotrowski, Kavanagh, Powers, Fick, Klein, Adamowski, Kovarik, S. M. Hogan.

Schools, Fire and Civil Service. Meets on Thursdays at 11:00 A. M.—ARMITAGE, Coughlin, Jackson, Madderom, Horan, Shaffer, Kaindl, Piotrowski, Devereux, Kavanagh, Fick, Albert, Hendricks, Schlegel, O'Toole, S. M. Hogan, A. O. Anderson, Kostner.

Harbors, Wharves and Bridges. Meets on Wednesdays at 11:00 A M. WOODHULL, Kenna, Rutkowski, Shaffer, Smith, Piotrowski, Powers, Agnew, Albert, Wallace, Haderlein, Caspers, Jensen, Lyle, Garner.

Public Health. Meets on Fridays at 11:00 A. M.—GARNER, Kenna, Jackson, Johntry, Furman, Rutkowski, Cermak, Horne, Czekala, Devereux, Kavanagh, Brieske, Frankhauser, Caspers, Moran, Wilson.

Track Elevation. Meets on Wednesdays at 11:00 A. M.—MAYPOLE, Coughlin, Mulcahy, Furman, Govier, McNichols, Horan, Cermak, Devereux, Touhy, Fick, Crowe, Klein, Hendricks, Jensen, Kovarik, W. J. Lynch, Moran, Kostner.

Police and Municipal Courts. Meets on Mondays at 11:30 A. M.—STEFFEN, Kenna, Johntry, McDonough, Eaton, Woodhull, Rutkowski, Cepak, Horne, Maypole, Czekala, Franz, Agnew, Frankhauser, Hendricks, Schlegel, Byrne, Wilson, A. O. Anderson.

Streets and Alleys. Meets on Mondays at 10:30 A. M.—TOMAN, Coughlin, T. A. Hogan, Mulcahy, Govier, Rutkowski, Cepak, Czekala, Devereux, Kavanagh, Powers, Fick, Agnew, Klein, Jensen, Adamowski, Kovarik, W. J. Lynch, Moran.

High Costs and High Rents. Meets on Saturdays at 10:30 A. M.—GOVIER, Mulcahy, Furman, Kaindl, Czekala, Devereux, Touhy, Albert, Steffen, Brieske, Caspers, Schlegel, Kovarik, S. M. Hogan.

Public Markets. Meets on Tuesdays at 11:30 A. M.—KAVANAGH, Furman, McNichols, Walkowiak, Bowler, Franz, Albert, Brieske, Hendricks, Jensen, Schlegel, Kovarik, Lyle, A. O. Anderson, Clark.

Municipal Institutions and City Hall. Meets on Mondays at 2:00 P. M.—SHAFFER, Johntry, McDonough, Touhy, Fick, Crowe, Haderlein, Hendricks, Schlegel, Byrne, W. J. Lynch, Wilson, Toman.

Efficiency, Economy and Rehabilitation. Meets on Thursdays at 11:00 A. M.—EATON, Richert, Olsen, Klein, Steffen, Frankhauser, Caspers, Wilson, Garner, Clark.

License. Meets on Tuesdays at 11:30 A. M.—PIOTROWSKI, Coughlin, Richert, Govier, Horan, Kaindl, Czekala, Franz, Klein, Wallace, Toman.

Redistricting. Meets on Saturdays at 10:00 A. M.—BYRNE, Kenna, Richert, Eaton, Madderom, Cermak, Horne, Smith, Olsen, Bowler, Agnew, Wallace, Link, Armitage, W. J. Lynch, Lyle, Clark.

Parks, Playgrounds and Beaches. Meets on Wednesdays at 11:00 A. M.—McDONOUGH, Kenna, L. B. Anderson, Johntry, Cepak, Piotrowski, Touhy, Albert, Haderlein, Brieske, O'Toole.

Gas Litigation. Meets subject to call of Chairman.—GUERNSEY, L. B. Anderson, Schwartz, Richert, McDonough, Eaton, Woodhull, Crowe, Frankhauser, Kostner. . . . .

Aviation. Meets on Mondays at 4:00 P. M. LINK, Maypole, Crowe, Adamowski, Wilson.

Committees and Rules. Meets subject to call of Chairman. SCHWARTZ (alternate Guernsey), Cermak (alternate, Woodhull), Bowler (alternate, Fick), Armitage (alternate, Adamowski), O'Toole (alternate, S. M. Hogan).

DECISIONS RENDERED BY THE NATIONAL BOARD FOR JURISDICTIONAL AWARDS IN THE BUILDING INDUSTRY

AIR COOLERS, AIR WASHERS AND BLOWERS, CONSISTING OF THE ASSEMBLING OF SHEET METAL AND PIPE FITTING.

(Subject of dispute between the Amalgamated Sheet Metal Workers International Alliance and the United Association of Plumbers and Steamfitters.)

Decision Rendered March 11, 1920.

The following agreement between the Amalgamated Sheet Metal Workers' International Alliance and the United Association of Plumbers and Steamfitters was confirmed:

September 9, 1918.

The undersigned committee, appointed by the general Presidents of their respective International Organizations; namely, the United Association of Plumbers, Steamfitters and Steamfitters' Helpers, and the Amalgamated Sheet Metal Workers' International Alliance, held joint conferences in the City of New York, beginning September 5, 1918, in an endeavor to arrive at an agreement concerning air washers, fans, blowers, the housing of same, and the pipe fitting on same.

After lengthy meetings participated by all of the undersigned, representing the joint Conference Committee of both International Unions, the following has been agreed to:

Section 1. That all sheet metal work of No. 10 gauge, or lighter, when used on air washers, fans, blowers or on the housing of same, shall be recognized as being the work of the members of the Amalgamated Sheet Metal Workers' International Alliance.

Section 2. That all pipe fitting in connection with the above first section shall be recognized as being the work of the steamfitters, members of the United Association of Journeymen Plumbers, Steamfitters and Steamfitters' Helpers.

Section 3. It being thoroughly understood by all of the undersigned that all of the assembling and erecting of the work as defined in Section 1, shall be the work of the members of the Sheet Metal Workers' International Alliance, excepting pipe fitting of all kinds, which shall be the work of the steamfitters and steamfitters' helpers of the United Association.

Section 4. This agreement shall become effective and in full operation for all parties concerned beginning November 1, 1918.

Signed for Sheet Metal Workers this 9th day of September 1918:

Signed for United Association.

LOW PRESSURE HEAT

(Subject of dispute between the United Association of Plumbers and Steamfitters and the International Union of Steam Engineers in the matter of maintaining temporary heat while structure is in course of construction.)

Decision Rendered March 11, 1920.

In the matter of the controversy between the engineer and the steamfitter on the question of low pressure heat during completion of the heating system, jurisdiction shall rest with the steamfitters until the initial test is completed, immediately after which time, whenever necessary to maintain heat, a stationary engineer shall be employed either by the contractor or by the owner.

PIPE RAILING OR GUARDS FOR ENCLOSURES, STAIRWAYS, HATCHES, ETC.

Subject of dispute between the Bridge and Structural Iron Workers' International Association and the United Association of Plumbers and Steamfitters. Claimed by the Iron Workers entirely except when not used as a conduit for fluids or vapors; claimed by Plumbers and Steamfitters when of standard sized cut and threaded pipe.)

Decision Rendered March 11, 1920.

Pipe railing consisting of standard-sized cut and threaded pipe, not used in connection with structural or ornamental iron work, is awarded to the United Association of Plumbers and Steamfitters.

Interpretation Rendered September 15, 1920.

"Iron pipe railing consisting of a preponderance of slip-joints made rigid with or without set-screws, pinions or rivets, supported by a threaded joint and flange at base or wall, is the work of the Iron Workers. Where, however, the preponderance of joints is of standard-sized cut and threaded iron pipe, it belongs to the Plumbers and Steamfitters."

RE-ENFORCED CONCRETE, CEMENT AND FLOOR CONSTRUCTION.

(Subject of dispute between the Bridge and Structural Iron Workers' International Association and the Wood, Wire and Metal Lather's International Union.)

Decision Rendered March 11, 1920.

In the matter of controversy between the Iron Workers and Lathers over re-enforced concrete construction, it is decided that all iron and steel used for re-enforcement in re-enforced concrete, cement and floor construction be awarded to the Iron Workers.

In such cities or localities as are covered by existing agreements with employers awarding Lathers control over re-enforced concrete construction, these agreements are to be maintained inviolate until the date of their expiration, after which this decision shall prevail.

Interpretation Rendered December 4, 1920.

In the interpretation of this Board's decision of March 11, 1920, in the matter of the controversy between the Iron Workers and Lathers over re-enforced concrete construction it is not to be understood as abrogating, setting aside or in any way altering the decision of the Rochester Convention of the Building Trades Department, November 29, 1912, awarding jurisdiction over Hy-rib Lath to the Wood, Wire and Metal Lathers' International Union, and it is to be understood that the placing of Hy-rib Lath or any ribbed metal lath, however, it may be used, comes within the jurisdiction of the Wood, Wire and Metal Lathers' International Union.

VITROLITE AND SIMILAR OPAQUE GLASS.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the Brotherhood of Painters, Decorators and Paperhangers.)

Decision Rendered March 11, 1920.

That in the matter of the controversy between the Painters and Bricklayers on the subject herewith referred to, jurisdiction over the setting of vitrolite and similar opaque glass is awarded to the Bricklayers, Masons and Plasterers' International Union.

CUTTING CHASES OR CHANNELS IN BRICK TILE, MASONRY, ETC.

(Subject of dispute between the Bricklayers, Masons, and Plasterers' International Union and the International Brotherhood of Electrical Workers.)

Decision Rendered March 11, 1920.

That in the matter of the controversy between the Bricklayers and Electrical Workers concerning the question of cutting grooves, channels, chases, etc., the Bricklayers are awarded jurisdiction over the work except when channels do not exceed

Wrigley Bldg., Chicago Graham, Anderson, Probst & White Architects

two inches by two inches in size or require labor not to exceed eight hours continuous time in which case the award is in favor of the Electrical Workers.

Note: This decision does not contemplate the channelling or cutting of granite or hard stone.

ASBESTOS PLASTER FOR BOILER ROOMS, ETC.

(Subject of dispute between the Operative Plasterers and Cement Finishers' International Association and the International Association of Heat and Frost Insulators and Asbestos Workers.)

Decision Rendered April 28, 1920.

In the dispute between the Asbestos Workers and Plasterers on the matter of plastering boiler rooms, etc., it is decided that the insulation and finishing coat on ceilings with asbestos and other insulating material, where the ground work has been prepared and installed by the asbestos worker, shall, including the application of insulating material on boilers, tanks, vats, etc., be awarded to the asbestos worker.

ASBESTOS SHINGLES, PREPARED PAPER ROOFING, ASPHALT ROLL ROOFING, SHINGLES AND STRIP SHINGLES.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.)

Decision Rendered April 28, 1920.

On the question in controversy between the Roofers and Carpenters on the subjects contained in the title, it is decided as follows:

Asbestos Shingles, Prepared Paper Roofing, Asphalt Roll Roofing awarded to the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.

Asphalt Shingles, Strip Shingles awarded to the United Brotherhood of Carpenters and Joiners.

BESTWALL, WHEN APPLIED AS A SUBSTITUTE FOR LATH AND PLASTER.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners, Operative Plasterers and Cement Finishers' International Association and International Union of Wood, Wire and Metal Lathers.)

Decision Rendered April 28, 1920.

In the matter of material known as Bestwall, forming a contention between the Carpenters, Plasterers and Lathers, jurisdiction shall rest with the Carpenters where material is paneled or used as sheathing; when cut, fitted and pointed, the Plasterers are recognized to have jurisdiction.

ERECTION OF SCAFFOLDS AS APPLIED TO BUILDING CONSTRUCTION.

(Subject of dispute between the International Hod Carriers, Building and Common Laborers' Union, United Brotherhood of Carpenters and Joiners, Operative Plasterers and Cement Finishers' International Association and Bricklayers, Masons and Plasterers' International Union.)

Decision Rendered April 28, 1920.

In the matter of the dispute between the Laborers, Bricklayers, Plasterers and Carpenters over the erection of scaffolds as applied to building construction, it is agreed that the erection and removal of all scaffolds including trestles ond horses used primarily by Lathers, Plasterers, Bricklayers and Masons shall be done by the Mechanics and Laborers in these trades as directed by the employer.

Self-supporting scaffolds over fourteen feet in height or any special designed scaffold or those built for special purposes shall be built by the Carpenters.

The making of horses and trestles other than temporary is the work of the Carpenter.

LIGHT IRON FURRING, BRACKETS, CLIPS, HANGERS, CORNER GUARDS, BEADS AND METALLIC LATH.

(Subject of dispute between the International Union of Wood, Wire and Metal Lathers and the International Association of Bridge and Structural Iron Workers.)

(Award of the Denver Convention, Building Trades Department, A. F. of L. adopted November, 1908. See printed proceedings, pages 69 to 71 inclusive.

Decision Rendered April 28, 1920.

In the matter of dispute between the International Union of Wood, Wire and Metal Lathers and the International Association of Bridge and Structural Iron Workers referred to in the foregoing title the following award is concurred in:

"After going into an extended hearing of the jurisdiction claims of both organizations, your committee recommends that the erection and installation of all light iron work, such as light iron furring, brackets, clips, hangers, steel corner guards or beads, and metallic lathing of all descriptions, belongs solely to the lather.

"This does not give the right, however, to the lathers to install or erect any other iron work than as herein specified and outlined.

"This decision is based in conformity with the agreement entered into by the national officers of both organizations and endorsed by the Kansas City Convention of Structural Iron Workers and concurred in by the American Federation of Labor."

In supplement of the foregoing decision the Rochester Convention of the Building Trades Department, November 29, 1912, awarded jurisdiction over Hy-rib lath to the Wood, Wire and Metal Lathers' International Union.

METALLIC CORNER BEADS WHEN SET IN PLASTIC MATERIAL

(Subject of dispute between the Operative Plasterers and Cement Finishers' Association and the Wood, Wire and Metal Lathers' International Union.)

Decision Rendered March 11, 1920.

In the matter of the controversy between the Plasters and Lathers on the question of the adherence of corner beads by plastic material, it is the opinion of the Board that deserved consideration was not given the subject when the previous decision was reached. It is therefore agreed that the Plasterers are awarded jurisdiction over sticking with plastic material metallic corner beads.

ACETYLENE AND ELECTRIC WELDING.

(Subject of dispute between the trades named in the following memorandum.)

Decision Rendered April 28, 1920.

In the matter of the dispute referred to in the foregoing title, as approved by the Philadelphia Convention of the Building Trades Department, A. F. of L., November, 1914 (see printed proceedings, page 99), the following agreement is concurred in:

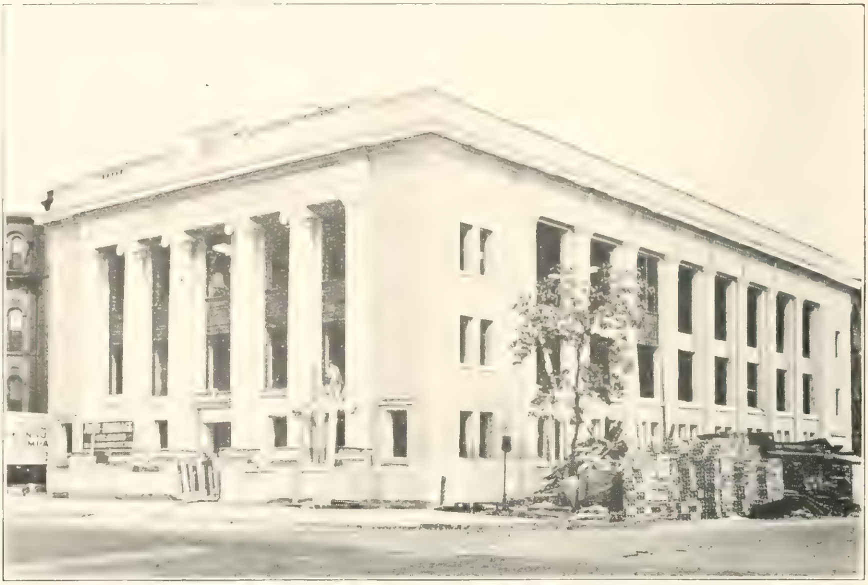
"Representatives of the Electrical Workers, Sheet Metal Workers, Iron Workers, Plumbers and Steam Fitters, and Machinists mutually agreed to the following decision:

"Each trade to have jurisdiction over all acetylene and electric welding when such process is used to perform the work of their respective trades."

BRONZING AND PAINTING OF RADIATORS AND PIPE CONNECTIONS.

(Subject of dispute between the Brotherhood of Painters, Decorators and Paperhangers and the United Association of Plumbers and Steam Fitters.)

(Award of Rochester Convention, Building Trades Department, A. F. of L., adopted November 29, 1912. See page 141, printed proceedings.)



Public Life Insurance Bldg., Chicago, Ill.

Charles S. Frost, *Architect*

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in:

Resolved, That the United Association of Plumbers and Steam Fitters be and is instructed to require that its affiliated unions desist from further trespass upon the jurisdiction of the Brotherhood of Painters, Decorators and Paperhangers of America, and when and where necessary to notify their employers that neither journeymen nor helpers will be permitted to do this work.

CORK TILING, LAYING OR SETTING OF

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the Bricklayers, Masons and Plasterers' International Union.)

Decision Rendered April 28, 1920.

In the matter of the dispute referred to in the foregoing title, the following agreement is concurred in:

Agreement entered into this 14th day of October, 1913, by and between representatives of the United Brotherhood of Carpenters and Joiners, and representatives of Bricklayers, Masons and Plasterers' International Union.

Jurisdiction is hereby conceded the Bricklayers, Masons and Plasterers' International Union to the laying or setting of all cork tiling when laid or set in any composition of sand and Portland cement.

Jurisdiction is hereby conceded the United Brotherhood of Carpenters and Joiners to the laying or setting of all cork tiling when laid or set in any composition of glue or when nails or brads are used in laying above referred to cork tilings.

APPLICATION OF DAMP-RESISTING PREPARATIONS AND WATER-PROOFING.

(Subject of dispute between United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association, and the Brotherhood of Painters, Decorators and Paperhangers.)

Decision Rendered April 28, 1920.

In the matter of dispute referred to in the foregoing title, the following agreement is concurred in:

Agreement entered into by and between the Brotherhood of Painters, Decorators and Paperhangers of America and the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association.

First. That the painters do not claim the right to apply any of the material claimed by the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association, except such material as is applied by a brush that is ordinarily covered in their jurisdiction.

Second. That the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers' Association does not claim the right to apply any of the material in dispute except when applied by or with a three-knot, long-handled brush, mop or swab, and spray system employed therein.

MARBLE AND SLATE PARTITIONS, BACKS AND FLOOR SLABS FOR URINAL STALLS, CLOSETS AND SHOWERS, SETTING OF.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the United Association of Plumbers and Steam Fitters.)

(Award of Rochester Convention, Building Trades Department, A. F. of L., adopted November 28, 1912. See page 132, printed proceedings. Award of Buffalo Convention November 9, 1917. See page 92, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in:

Resolved, That the setting of floor slabs, backs, partitions of urinal stalls, closets and shower baths properly belong to the Bricklayers, Masons and Plasterers' International Union.

The foregoing decision does not concede to the Bricklayers the right to install marble work that is connected with the water supply or sewer or water-tight work regularly catalogued as plumbing fixtures.

MUSLIN AND CANVAS FOR DECORATIVE PURPOSES, TACKING OF

(Subject of dispute between the Brotherhood of Painters, Decorators and Paperhangers and the I. A. Heat and Frost Insulators and Asbestos Workers.)

(Award of Buffalo Convention, Building Trades Department, A. F. of L., adopted November 10, 1917. See page 108, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in.

Resolved, That this convention notify and instruct the officers of the Asbestos Workers' International Union that the tacking of all muslin and canvas for decorative purposes is the jurisdiction of the Brotherhood of Painters and that they instruct their members to refrain from doing any of this work.

PILE DRIVING MACHINERY AND ENGINES, OPERATION OF

(Award of Buffalo Convention, Building Trades Department, A. F. of L., adopted November, 1917. See pages 59 to 105, printed proceedings.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in.

Such workmen as are employed in the operation of engines or machinery in connection with a pile driver come under the jurisdiction of the International Union of Steam Engineers.

SHEET METAL GLAZING FOR SASH, FRAMES, DOORS, SKYLIGHTS, ETC.

(Subject of dispute between the Brotherhood of Painters, Decorators and Paperhangers and Amalgamated Sheet Metal Workers' International Alliance.)

Decision Rendered April 28, 1920.

In the matter of dispute referred to in the foregoing title, the following agreement is concurred in:

Agreement entered into by and between the General Executive Board of the Brotherhood of Painters, Decorators and Paperhangers of America, and the Amalgamated Sheet Metal Workers' International Alliance, shall take effect December 1, 1910, and remain in force until amended, revised or changed, at a meeting between three representatives of both organizations called for this purpose.

Section 1. It is agreed by both parties to this agreement that all glass set in sheet metal sash, frames, doors, or skylights, shall be set by members of the Brotherhood of Painters, Decorators and Paperhangers of America, according to their claim of jurisdiction granted by the convention of the Building Trades Department, A. F. of L., at St. Louis, December, 1910; and that all sheet metal work on sheet metal sash, frames, doors or skylights shall be done by the members of the Amalgamated Sheet Metal Workers' International Alliance.

Section 2. In localities where differences now exist or may arise in the future, such differences shall be adjusted by a committee appointed by and representing the district councils or local unions of both organizations in that locality. Should this committee be unable to agree, a representative of the General Executive Board of each organiza-

tion shall be called in to assist in the adjustment.

Section 3. It is also agreed that the national officers of both organizations where local unions fail to agree shall insist that this agreement be carried out by affiliated unions.

SLATE TREADS WHEN SET ON IRON STAIR CASE.

(Subject of dispute between Bricklayers, Masons and Plasterers' International Union, and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered April 28, 1920.

In the matter of the subject referred to in the foregoing title, the following award is concurred in.

Slate treads on iron stairs having provoked a dispute in jurisdiction between the organizations above named, was submitted to the Executive Council November 29, 1909. The action taken follows:

The Executive Council of the Building Trades Department on being called upon for a decision awarded the work in question (slate treads) to the Bricklayers, Masons and Plasterers' International Union.

UNSKILLED LABOR, WITH SPECIAL REFERENCE TO THE LOADING AND UNLOADING OF MATERIAL AS APPLIED TO REINFORCED CONCRETE CONSTRUCTION.

(Subject of dispute between the International Hod Carriers, Building and Common Laborers' Union, and International Association of Bridge and Structural Iron Workers.)

Decision Rendered August 2, 1920.

It is the decision of the Board that the loading, unloading, carrying and handling of all rods and material for use in reenforced concrete construction shall be done by the laborers under the supervision of such person as the employer may designate. The hoisting of rods, except when a derrick or outrigger is used, shall be done by laborers—this decision to apply only to the character of work stipulated herein. In such localities where existing agreements provide otherwise, this decision is to become effective at the expiration thereof.

DEFECTS IN CONCRETE CAUSED BY LEAKAGE, BULGING, SAGGING, ETC., THROUGH DEFECTIVE OR SHIFTING FORMS.

(Subject of dispute between the Operative Plasterers and Cement Finishers' International Association and the International Hod Carriers, Building and Common Laborers' Union.

Decision Rendered August 2, 1920.

Where finishing tools are not used or required the work shall be done by the laborer. The filling of voids and other work requiring patching, where finishing tools are used and required, shall be done by the cement finisher.

SETTING AND ALIGNMENT OF TILE AND PORCELAIN BATHROOM ACCESSORIES.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union and the United Association of Plumbers and Steam Fitters.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Tile Layers and Plumbers over Setting and Alignment of Tile and Porcelain Bathroom Accessories, it is decided that all bath and toilet room accessories made of clay products, built in tile-faced walls, shall be the work of the tile setter.

METAL FLOOR DOMES.

(Subject of dispute between the Amalgamated Sheet Metal Workers' International Alliance, the International Union of Wood, Wire and Metal Lathers and the United Brotherhood of Carpenters and Joiners.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers, Lathers and Carpenters over metal floor domes, it is decided that the placing of metal floor domes, whether temporary or permanent, whenever supported by wood props or other wood supports and used as forms for concrete construction, come within the jurisdiction of the Carpenters.

JURISDICTION OVER FOREMEN ON INTERIOR CONCRETE COLUMNS, FOUNDATIONS FOR ENGINE AND MACHINERY BEDS.

(Subject of dispute between the Bricklayers, Masons and Plasterers' International Union, International Hod Carriers, Building and Common Laborers' Union and the Operative Plasterers and Cement Finishers' International Association.)

Decision Rendered December 4, 1920.

In the matter of the jurisdiction over Foremen on Interior Concrete Columns, Foundations for Engine and Machinery Beds, as contested by the Bricklayers, Hod Carriers and Plasterers, it is the decision of the Board that the work shall be done by the Laborers under the supervision of such skilled workmen as the employer may designate.

ELECTRICAL WORK ON ELEVATORS. (Rehearing.)

(Subject of dispute between the International Brotherhood of Electrical Workers and the International Union of Elevator Constructors.)

Decision Rendered December 4, 1920.

In the matter of the dispute between the Elevator Constructors and the Electrical Workers on the question of all electrical work on elevators, it is agreed that the electrical work involved in the installation of signal systems, fans, telephones, electric light fixtures and illuminated thresholds and electrical interlocking devices except on automatic elevators, and feed wires to the controller, is awarded to the Electrical Workers.

BISHOPRIC BOARD, WHEN APPLIED AS A SUBSTITUTE FOR LATH AND SHEATHING.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the International Union of Wood, Wire and Metal Lathers.)

Decision Rendered December 4, 1920.

In the matter of the dispute over the installation of Bishopric Board when applied as a substitute for lath, it is the decision of the Board that the work shall be done by the Lathers; where the same is used for sheathing it shall be the work of the Carpenters.

FLAXLINUM KEYBOARD AND INSULATION.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the International Union of Wood, Wire and Metal Lathers.)

Decision Rendered December 4, 1920.

In the matter of the dispute over the installation of Flaxlinum Keyboard and insulation, it is the decision of the Board that when the same is used as a substitute for lath or when any plastic material is to be applied, the work shall be done by the Lathers; when Flaxlinum is used as insulation of sheathing it shall be the work of the Carpenters.

HOLLOW METAL DOORS AND TRIM.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the Amalgamated Sheet Metals Workers' International Alliance.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers and Carpenters over Hollow Metal Doors and Trim, it is

decided that the hanging of such doors, except sliding doors, the installation of the door frames, the placing of the trim around door or other openings and the placing of all other metal trim, is the work of the Sheet Metal Workers whenever the metal is of No. 10 gauge or lighter.

Decision Rendered March 12, 1921.

In the matter of the controversy between the International Association of Bridge and Structural Iron Workers and the Amalgamated Sheet Metal Workers' International Alliance relative to Hollow Metal Doors and Trim, it is decided that the erection of hollow metal doors, made entirely of ten gauge metal or lighter, except for local re-enforcement, and the installation of the door frames and trim in direct connection with such doors is the work of the Sheet Metal Workers; except that in the case of sliding doors, street entrance and vestibule doors, elevator, shipping room and freight doors, and doors used exclusively for fire purposes, the work is that of the Iron Workers. Kalamein or other wood-core doors are not covered by this decision.

Metal Partitions.

The erection of metal partitions of ten gauge metal or lighter, unless the structural framing of such partitions consists of rolled shapes or drawn tubing is the work of the Sheet Metal Workers. In other cases it is the work of the Iron Workers.

HOLLOW SHEET METAL WINDOW FRAMES AND SASH.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners and the Amalgamated Sheet Metal Workers' International Alliance.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers and the Carpenters over Hollow Sheet Metal Window Frames and Sash, it is decided that the setting of hollow metal window frames and the hanging of hollow metal sash, when such frames and sash are made of No. 10 gauge metal or lighter, is the work of the Sheet Metal Workers.

Decision Rendered March 12, 1921.

In the matter of the controversy between the Amalgamated Sheet Metal Workers' International Alliance and International Association of Bridge and Structural Iron Workers over Hollow Sheet Metal Window Frames and Sash, it is decided that the setting of hollow metal window frames and the hanging of hollow metal sash, when such frames and sash are made of No. 10 gauge metal or lighter, is the work of the Sheet Metal Workers. The Campbell Window and Sash not being of hollow metal, its erection is awarded to the Iron Workers.

METAL FORMS FOR CONCRETE COLUMNS.

(Subject of dispute between the United Brotherhood of Carpenters and Joiners, Amalgamated Sheet Metal Workers' International Alliance and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered December 4, 1920.

In the matter of the controversy between the Sheet Metal Workers, Carpenters, and Iron Workers over metal forms for concrete columns, it is decided that the setting up of such forms of No. 10 gauge metal or lighter is the work of the Carpenters, and when heavier than No. 10 gauge it is the work of the Iron Workers.

SCHOOL AND THEATRE SEATS, SETTING OF

(Subject of dispute between the Amalgamated Sheet Metal Workers' International Alliance, United Brotherhood of Carpenters and Joiners and International Association of Bridge and Structural Iron Workers.)

Decision Rendered March 12, 1921.

In the matter of the controversy between the Amalgamated Sheet Metal Workers' International Alliance, United Brotherhood of Carpenters and Joiners and International Association of Bridge and Structural Iron Workers relative to the setting of school and theatre seats, it is decided that the work in question be awarded to the Carpenters.

SHEET METAL HOPPERS AND SPOUTS IN GRAIN ELEVATORS.

(Subject of dispute between the Almalgamated Sheet Metal Workers' International Alliance, International Association of Bridge and Structural Iron Workers and United Brotherhood of Carpenters and Joiners.)

Decision Rendered February 7, 1922.

In the matter of the dispute between the Amalgamated Sheet Metal Workers' International Alliance, International Association of Bridge and Structural Iron Workers and United Brotherhood of Carpenters and Joiners referred to in the foregoing title, it is decided that all metal work relating to hoppers and spouts in grain elevators when made of No. 10 gauge or lighter metal, including reinforcement of light iron, cold riveted or bolted, be awarded to the Amalgamated Sheet Metal Workers' International Alliance; when heavier than No. 10 gauge the work is awarded to the International Association of Bridge and Structural Iron Workers.

HOISTING, LOWERING AND PLACING OF ELEVATOR MACHINERY.

(Subject of dispute between the Elevator Constructors' International Union and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered February 7, 1922.

In the matter of the dispute between the Elevator Constructors' International Union and the International Association of Bridge and Structural Iron Workers referred to in the foregoing title, it is decided that the Elevator Constructors' International Union be awarded the Hoisting, Lowering and Placing of Elevator Machinery.

SHEET METAL HOPPERS AND SPOUTS IN GRAIN ELEVATORS.

(Subject of dispute between the Amalgamated Sheet Metal Workers' International Alliance, International Association of Bridge and Structural Iron Workers and United Brotherhood of Carpenters and Joiners.)

Decision Rendered February 7, 1922.

In the matter of the dispute between the Amalgamated Sheet Metal Workers' International Alliance, International Association of Bridge and Structural Iron Workers and United Brotherhood of Carpenters and Joiners referred to in the foregoing title, it is decided that all metal work relating to Hoppers and Spouts in Grain Elevators when made of ten gauge or lighter metal, including reenforcement of light iron, cold riveted or bolted, be awarded to the Amalgamated Sheet Metal Workers' International Alliance; when heavier than ten gauge the work is awarded to the International Association of Bridge and Structural Iron Workers.

HOISTING, LOWERING AND PLACING OF ELEVATOR MACHINERY.

(Subject of dispute between the Elevator Constructors' International Union and the International Association of Bridge and Structural Iron Workers.)

Decision Rendered February 7, 1922.

In the matter of the dispute between the Elevator Constructors' International Union and the International Association of Bridge and Structural Iron Workers referred to in the foregoing title, it is decided that the Elevator Constructors' International Union be awarded the Hoisting, Lowering and Placing of Elevator Machinery.

Illinois Merchants Bank Building. Graham, Anderson, Probst & White, Architects.

MECHANICS LIEN LAW

State of Illinois

AN ACT

To Revise the Law in Relation to Mechanics' Liens; To Whom, What For and When Lien Is Given; Who Is a Contractor; Area Covered by and Extent of Lien; When the Lien Attaches. (Approved May 18, 1903; in Force July 1, 1903; as Amended by Act Approved June 16, 1913, in Force July 1, 1913.)

Section 1. **When Lien Given.)** Be it Enacted by the People of the State of Illinois, Represented in the General Assembly: That any person who shall by any contract or contracts, express or implied, or partly expressed or implied, with the owner of a lot or tract of land, or with one whom such owner has authorized or knowingly permitted to contract for the improvement of, or to improve the same, furnish material, fixtures, apparatus or machinery, forms or form work used in the process of construction where cement, concrete or like material is used for the purpose of or in the building, altering, repairing or ornamenting any house or other building, walk or sidewalk, whether such walk or sidewalk be on the land or bordering thereon, driveway, fence or improvement or appurtenances thereto on such lot or tract of land or connected therewith, and upon, over or under a sidewalk, street or alley adjoining; or fill, sod or excavate such lot or tract of land, or do landscape work thereon or therefor; or raise or lower any house thereon or remove any house thereto; or perform sevices as an architect or as a structural engineer for any such purpose; or furnish or perform labor or services as superintendent, timekeeper, mechanic, laborer or otherwise, in the building, altering, repairing or ornamenting of the same; or furnish material, fixtures, apparatus, machinery, labor or services, forms or form work used in the process of construction where concrete, cement or like material is used, on the order of his agent, architect, structural engineer or superintendent having charge of the improvements, building, altering, repairing or ornamenting the same, shall be known under this Act as a contractor, and shall have a lien upon the whole of such lot or tract of land and upon the adjoining or adjacent lots or tracts of land of such owner constituting the same premises and occupied or used in connection with such lot or tract of land as a place of residence or business; and in case the contract relates to two or more buildings, on two or more lots or tracts of land, upon all such lots and tracts of land and improvements thereon for the amount due to him for such material, fixtures, apparatus, machinery, services or labor, and interest from the date the same is due. This lien shall extend to an estate in fee, for life, for years, or any other estate or any right of redemption, or other interest which such owner may have in the lot or tract of land at the time of making such contract or may subsequently acquire therein, and shall be superior to any right of dower of husband or wife in said premises, provided the owner of such dower interest had knowledge of such improvement and did not give written notice of his or her objection to such improvement before the making thereof; nor shall the taking of additional security by the contractor or sub-contractor be a waiver of any right of lien which he may have by virtue of this Act, unless made a waiver by express agreement of the parties; and this lien shall attach as the date of the contract. (As amended by Act approved June 28, 1919.)

Section 2. **Liens for Work or Materials by Mistake Put Upon Land Other Than the Contracting Parties.)** Any person furnishing services, labor or material for the erection of a building, or structure, or improvement, by mistake, upon land owned by another than the party contracting as owner, shall have a lien for such services, labor or material upon such building, or structure, or improvement, and the court, in the enforcement of such lien, shall order and direct such building, structure or improvement to be separately sold under its decree, and the purchaser may remove the same within such reasonable time as the court may fix.

Section 3. **Liens for Work or Materials Under Contract with Husband on Land of Wife.)** If any such services or labor are performed upon or materials are furnished for lands belonging to any married woman with her knowledge and not against her protest in writing, as provided in Section 1 of

SHERIDAN PLAZA HOTEL, CHICAGO

W. W. Ahlschlager, Architect

RUDOLPH S. BLOME — WILLIAM J. SINEK

Blome Sinek Company

(A CO-PARTNERSHIP)

BUILDING CONSTRUCTION

139 NORTH CLARK STREET, CHICAGO

National City Life Building, New York

this Act, in pursuance of a contract with the husband of such married woman, the person furnishing such labor or materials shall have a lien upon such property, the same as if such contract had been made with (the) married woman, and in case the title to such lands upon which improvements are made is held by husband and wife jointly, the lien given by this Act shall attach to such lands and improvements, if the improvements be made in pursuance of a contract with both of them, or in pursuance of a contract with either of them, and in all such cases no claim of homestead right set up by a husband or wife shall defeat the lien given by this Act.

Section 4. **Breach of Contract by Owner—Recovery for Material—Partial Performance—Quantum Meruit—Right to Reclaim—Unused Material.)** When the owner of the land shall fail to pay the contractor moneys justly due him under the contract at the time when the same should be paid, or fails to perform his part of the contract in any other manner, the contractor may discontinue work, and the contractor shall not be held liable for any delay on his part during the period of, or caused by, such breach of contract on the part of the owner; and if, after such breach for the period of ten days, the owner shall fail to comply with his contract, the contractor may abandon the work, and in such case the contractor shall be entitled to enforce his lien for the value of what has been done, and the court shall adjust his claim and allow him a lien accordingly. In such cases all persons furnishing material which has not been incorporated in the improvement shall have the right to take possession of and remove the same if he so elects.

Section 5. **Contractors to Notify Owners of Sub-Contracts and Amounts of Their Claims—Owner's Duty with Regard Thereto and Rights in Case of Default—Contractor's Liability for Failure to Give Statement—Contractors to Whom This Section Does Not Apply.)** It shall be the duty of the contractor to give to the owner, and the duty of the owner to require of the contractor, before the owner or his agent, architect or superintendent, shall pay or cause to be paid to said contractor or to his order any moneys or other consideration due or to become due such contractor, or make or cause to be made to such contractor any advancement of any money or any other consideration, a statement in writing, under oath or verified by affidavit, of the names of all parties furnishing materials and labor, and of the amounts due or to become due each. Merchants and dealers in materials only shall not be required to make statements herein provided for.

Section 6. **Time for Completion of Contract.)** In no event shall it be necessary to fix or stipulate in any contract a time for the completion or a time for payment in order to obtain a lien under this Act: Provided, that the work is done or material furnished within three years from the commencement of said work or the commencement of furnishing said materials.

Section 7. **Limitations as Against Third Parties—Claim for Lien—What Shall Consist of—When Claim May be Filed and When Amended—As to Errors in—Proof of Delivery of Material, Not Use, Sufficient—Delivery of Material at One Building Good for All Buildings.)** No contractor shall be allowed to enforce such lien against or to the prejudice of any other creditor or incumbrancer or purchaser, unless within four months after completion, or if extra or additional work is done or material is delivered therefor within four months after the completion of such extra or additional work or the final delivery of such extra or additional material, he shall either bring suit to enforce his lien therefor or shall file with the clerk of the Circuit Court in the county in which the building, erection or other improvement to be charged with the lien is situated, a claim for lien, verified by the affidavit of himself, or his agent or employee, which shall consist of a brief statement of the contract, the balance due after allowing all credits, and a sufficiently correct description of the lot, lots or tracts of land to identify the same. Such claim for lien may be filed at any time after the contract is made, and as to the owner may be filed at any time after the contract is made and within two years after the completion of said contract, or the completion of any extra work or the furnishing of any extra material thereunder, and as to such owner may be amended at any time before the final decree. No such lien shall be defeated to the proper amount thereof because of an error or overcharging on the part of any person claiming a lien therefor under this Act unless it shall be shown that such error or overcharge is made with intent to defraud; nor shall any such lien for material be defeated because of lack of proof that the material after the delivery thereof, actually entered into the construction of such building or improvement, although it be shown that such material was not actually used in the construction of such building or improvement: Provided, it is shown that such material was delivered either to said owner or his agent for such building or improvement, to be used in said building or improvement, or at the place where said building or improvement was being constructed, for the purpose of being used in construction or for the purpose of being employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed forms or form work where concrete, cement or like material is used, in whole or in part: And, provided, further, that in case of the construction of a number of buildings under contract between the same parties, it shall be sufficient in order to establish such lien for material, if it be shown that such material was in good faith delivered at one of the said buildings for the purpose of being used in the construction of any one or all of such buildings, or delivered to the owner or his agent for such buildings, to be used therein; and such lien for such material shall attach to all of said buildings, together with the land upon which the same are being constructed, the same as in a single building or improvement: And, provided, further, that in the event the contract relates to two or more buildings on two or more lots or tracts of land, then all of said buildings and lots or tracts of land may be included in one statement of claim for a lien. (As amended by Act approved June 16, 1913, in force July 1, 1913.)

Section 8. **Assignability of Liens or Claims for Liens—Rights of Assignee.)** All liens or claims for lien which may arise or accrue under the terms of this Act shall be assignable, and proceedings to enforce such liens or claims for lien may be maintained by and in the name of the assignee, who shall have as full and complete power to enforce the same as if such proceedings were taken under the provisions of this Act by and in the name of the lien claimant.

Section 9. **When, How and in What Court Suit May be Brought—Two or More Lien Holders May Join in Bringing Suit—Answers Stand as Cross-Bills—Original Bill Cannot be Dismissed Without Consent of Parties—Lien Claimants May Contest Each Other's Claims Without Formal Issues of Record—Rights of in Case of Surprise—Limitation.)** If payment shall not be made to the contractor having a lien by virtue of this Act of any amount due when the same becomes due, then such contractor may bring suit to enforce his lien by bill or petition in any court of competent chancery jurisdiction in the county where the improvement is located, and in the event that the contract relates to two or more buildings or two or more lots or tracts of land, then all of said buildings and lots or tracts of land may be in-

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cluded in one bill or petition. Any two or more persons having liens on the same property may join in bringing such suit, setting forth their respective rights in their bill or petition; all lien claimants not made parties thereto may, upon application, become defendants and enforce their liens by answer to the bill or petition in the nature of an intervening petition, and the same shall be taken as a cross-bill against all the parties to such suit; and the said bill or petition shall not thereafter be dismissed as to any such lien claimant, or as to the owner or owners of the premises without the consent of such lien claimant. The complainant or petitioner, and all defendants to such bill or petition may contest each other's right without any formal issue of record made up between them other than that (shown) upon the original bill or petition, as well with respect to the amount due as to the right to the benefit of the lien claimed: Provided, that if by such contest by co-defendants any lien claimants be taken by surprise, the court may, in its discretion, as to such claim grant a continuance. The court may render judgment against any party summoned and failing to appear, as in other cases of default. Such suit shall be commenced or answer filed within two years after the completion of the contract, or completion of the extra or additional work, or furnishing of extra or additional material thereunder.

Section 10. **Personal Representatives—Death of Parties in Interest.)** Suits may be instituted under the provisions of this Act in favor of administrators or executors, and may be maintained against the representatives in the interest of those against whom the cause of action accrued, and in suits instituted under the provisions of this Act, the representatives of any party who may die pending the suit shall be made parties.

Section 11. **Who Are Parties in Interest—How and When Made—Or May Become Parties to Suit—Publication, Service of Process on Non-Resident—Claims Not Due, Etc.—Pleading, Requisites of Bill or Petition—Diligence Required in Prosecuting Claim—When and How Party Bringing Suit May Dismiss Same.)** The bill or petition shall contain a brief statement of the contract or contracts on which it is founded, the dates when made and when completed, if not completed, why, and it shall also set forth the amount due and unpaid, a description of the premises which are subject to the lien, and such other facts as may be necessary to a full understanding of the rights of the parties. Where plans and specifications are by reference made a part of the contract, it shall not be necessary to set the same out in the pleadings or as exhibits, but the same may be produced on the trial of the suit. The complainant or petitioner shall make all parties interested, of whose interest he is notified or has knowledge, parties defendant, and summons shall issue and service thereof be had as in suits in chancery; and when any defendant resides or has gone out of the State, or on inquiry cannot be found, or is concealed within the State, so that process cannot be served on him, the complainant or petitioner shall cause a notice to be given to him in like manner and upon the same conditions as is provided in suits in chancery, and his failure to so act with regard to summons or notice shall be ground for judgment or decree against him as upon the merits. The same rule shall prevail with cross-petitioners with regard to any person of whose interest they have knowledge, and who are not already parties to the suit or action. Parties in interest, within the meaning of this Act, shall include persons entitled to liens thereunder, whose claims are not, as well as are, due at the time of the commencement of suit, and such claim shall be allowed subject to a reduction of interest from the date of judgment to the time the claim is due; also all persons who may have any legal or equitable claim to the whole or any part of the premises upon which a lien may be attempted to be enforced under the provisions thereof, or who are interested in the subject matter of the suit. Any such persons may, on application to the court wherein the suit is pending, be made or become parties at any time before final judgment. No action or suit under the provisions of this Act shall be voluntarily dismissed by the parties bringing the same without due notice to all parties before the court and leave of court upon good cause shown and upon terms named by the court.

Section 12. **Practice—Powers of Courts—When Receivers May be Appointed.)** The court shall permit amendments to any part of the pleadings, and may issue process, make all orders requiring parties to appear, and requiring notice to be given, that are or may be authorized in proceedings in chancery, and shall have the same power and jurisdiction of the parties and subject matter, and the rules of practice and proceedings in such cases shall be the same as in other cases in chancery, except as is otherwise provided in this Act. The court shall have power to appoint receivers for property on which liens are sought to be enforced in the same manner, for the same causes and for the same purposes, as in cases of foreclosure of mortgages, as well as to complete any unfinished building where the same is deemed to be to the best interest of all the parties interested.

Section 13. **Practice—Answer—Defense—Right to Recover on Counter Claim.)** Defendant shall answer the bill or petition under oath, unless the oath is waived by the claimant or petitioner. The owner shall be entitled to make any defense against the contractor by way of set-off, recoupment or counter claim that he could in any action at law, and shall be entitled to the same right of recovery on proof of such in excess of the claim of the contractor against the contractor only, but for matters not growing out of the contract such recovery shall be made without prejudice to the rights of the subcontractors thereunder for payment of the contract price or fund; and in event that the court shall find, in any proceeding in chancery, that no right to a lien exists, the contractor shall be entitled to recover against the owner as at law, and the court shall render judgment as at law for the amount which the contractor is entitled to, together with costs, in the discretion of the court. In any proceedings to enforce a lien, it shall only be necessary for all persons seeking a lien on account of wages due for labor to file in such proceedings an affidavit, giving the amount due, between what dates the same was performed and the kind of labor performed, and the court shall direct the amount due for wages as therein specified to be paid within a short day to be fixed by the court, unless within ten days after the filing of said claim for wages the amount claimed is contested by the owner or some other party to the suit, and in order to contest the amount due for wages it shall be necessary for the party making such contest to file an affidavit in which he shall state the defense he has to the allowance of such claim, and the court shall proceed at once to hear such evidence as the parties may adduce, and determine the merits as to the allowance of such claim for wages, and in the event that the allowance for wages is not paid within the time fixed by the court, then the court shall order the premises sold to pay such amount, in such manner as the court shall direct.

Section 14. **Trials—Parties Ready Not to be Delayed—When Court May Delay Order for Sale or Distribution.)** In no case shall the want of preparation for trial of one claim delay the trial in respect to others, but trial shall be had upon issues between such parties as are prepared, without reference to issues between other parties; and when one creditor shall have obtained a decree or judgment for the amount due, the court may order a sale of the premises on which the lien operates, or a part thereof, so as to satisfy the decree or judgment;

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Provided, that the court may, for good cause shown, delay making any order for sale or distribution until the rights of all the parties in interest are ascertained and settled by the court.

Section 15. **Preference to Laborers—No Preference to First Contractors.)** Upon all questions arising between different contractors having lien under this Act, no preference shall be given to him whose contract was made first, except the claim of any person for wages by him personally performed shall be a preferred lien.

Section 16. **Incumbrances—Apportionment—On Improvements Made After Record of Incumbrance—Lien Holders Have Pro Rata Benefit in What Owner Pays For—Fraudulent Incumbrances—Disposition of.)** No incumbrance upon land, created before or after the making of the contract under the provisions of this Act, shall operate upon the building erected, or materials furnished, until a lien in favor of the persons having done work or furnished material shall have been satisfied, and upon questions arising between incumbrances and lien creditors, all previous incumbrances shall be preferred to the extent of the value of the land at the time of making of the contract, and the lien creditor shall be preferred to the value of the improvements erected on said premises, and the court shall ascertain by jury or otherwise, as the case may require, what proportion of the proceeds of any sale shall be paid the several parties in interest. All incumbrances, whether by mortgage, judgment or otherwise, charged and shown to be fraudulent, in respect to creditors, may be set aside by the court, and the premises freed and discharged from such fraudulent incumbrance.

Section 17. **Costs—How Taxed—Attorneys' Fees.)** The costs of proceedings, as between all parties to the suit, shall be taxed equitably against the losing parties, and where taxed against more than one party shall be so taxed against all in favor of the proper party, but equitably as between themselves; and the costs, as between creditors aforesaid in contests relative to each other's claims, shall be subject to the order of the court, and the same rule shall prevail in respect to costs growing out of the proceedings against and between incumbrances. In all cases where liens are enforced, the court shall, in its discretion, order a reasonable attorney's fee taxed as a part of the costs in favor of the lien creditor.

Section 18. **What Estate to be Sold—Manner of Making Sales, When Part May be Sold.)** Whatever right or estate such owner had in the land at the time of making the contract may be sold in the same manner as other sales of real estate are made under decrees in chancery. If any part of the premises can be separated from the residue, and sold without damage to the whole, and if the value thereof is sufficient to satisfy all the claims proved in the cause, the court may order a sale of that part.

Section 19. **Proceeds of Sale—Application of Pro Rata—Labor Claims Preferred—Deficiency Decrees—Excess, to Whom Paid.)** The court shall ascertain the amount due each lien creditor, and shall direct the application of the proceeds of sale to be made to each in proportion to their several amounts, according to the provisions of this Act, but the claims of all persons for labor, as provided in Section fifteen (15) shall first be paid. If, upon making sale under this Act, of any or all premises, the proceeds of such sale shall not be sufficient to pay all claims of all parties, according to their rights, the decree shall be credited by the amount of said sale, and execution may issue in favor of any creditor whose claims are not satisfied for the balance due as upon a deficiency decree in the foreclosure of a mortgage in chancery, and such deficiency decree shall be a lien upon all real estate and other property of the party against whom it is entered to the same extent and under the same limitations as a judgment at law; and in cases of excess of sales over the amount of the decree, such excess be paid to the owner of the land, or to the person who may be entitled to the same, under the direction of the court.

Section 20. **Redemption.)** Upon all sales under this Act, the right of redemption shall exist in favor of the same persons, and may be made in the same manner as is or may be provided for redemption of real estate from sales under judgments and executions at law.

Section. 21. **Sub-Contractors — Liens of Sub-Contractors—Who Are—Extent of Their Liens Superior to Creditors or Contractors on Money Due Contractors—Duty of Owner and Contractor to File Notice of Waiver of Lien—Limit of Owner's Liability—Owner Liable for Sub-Contracts Performed After Notice Thereof—Rights of in Case Contractor Default May Complete, If Contractor Abandons.)** Every mechanic, workman or other person who shall furnish any materials, apparatus, machinery or fixtures, or furnish or perform services or labor for the contractor, or shall furnish any material to be employed in the process of construction as a means for assisting in the erection of the building or improvement in what is commonly termed form or form work where concrete, cement or like material is used in whole or in part, shall be known under this Act as a sub-contractor, and shall have a lien for the value thereof, with interest on such amount from the date the same is due, from the same time, on the same property as provided for the contractor, and, also, as against the creditors and assignees, and personal and legal representatives of the contractor, on the material, fixtures, apparatus or machinery furnished, and on the moneys or other considerations due or to become due from the owner under the original contract. If the legal effect of any contract between the owner and contractor is that no lien or claim may be filed or maintained by any one, such provision shall be binding; but the only admissible evidence thereof as against a sub-contractor or material man, shall be proof of actual notice thereof to him before any labor or material is furnished by him; or proof that a duly written and signed stipulation or agreement to that effect has been filed in the office of the recorder of deeds of the county or counties where the house, building or other improvement is situated, prior to the commencement of the work upon such house, building or other improvement, or within ten days after the execution of the principal contract or not less than ten days prior to the contract of the sub-contractor or material man. And the recorder of deeds shall record the same at length in the order of time of its reception in books provided by him for that purpose, and the recorder of deeds shall index the same, in the name of the contractor and in the name of the owner, in books kept for that purpose, and also in the tract or abstract book of the tract, lot, or parcel of land, upon which said house, building or other improvement is located, and said recorder of deeds shall receive therefor a fee, such as is provided for the recording of instruments in his office.

In no case, except as hereinafter provided, shall the owner be compelled to pay a greater sum for or on account of the completion of such house, building or other improvement than the price or sum stipulated in said original contract or agreement, unless payment be made to the contractor or to his order, in violation of the rights and interests of the persons intended to be benefited by this Act: Provided, if it shall appear to the court that the owner and contractor fraudulently, and for the purpose of defrauding sub-contractors fixed an unreasonably low price in their original contract for the erection or repairing of such house, building or other improvement, then the

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court shall ascertain how much of a difference exists between a fair price for labor and material used in said house, building or other improvement, and the sum named in said original contract, and said difference shall be considered a part of the contract and be subject to a lien. But where the contractor's statement, made as provided in Section five (5), shows the amount to be paid to the sub-contractor, or party furnishing material, or the sub-contractor's statement, made pursuant to Section twenty-two (22), shows the amount to become due for material; or notice is given to the owner, as provided in Sections twenty-four (24) and twenty-five (25), and thereafter such subcontract shall be performed, or material to the value of the amount named in such statements or notice, shall be prepared for use and delivery, or delivered without written protest on the part of the owner previous to such performance or delivery, or preparation for delivery, then, and in any of such cases, such sub-contractor or party furnishing or preparing material, regardless of the price named in the original contracts, shall have a lien therefor to the extent of the amount named in such statements or notice. Also, in case of default or abandonment by the contractor, the sub-contractor or party furnishing material, shall have and may enforce his lien to the same extent and in the same manner that the contractor may under conditions that arise as provided for in Section four (4) of this Act, and shall have and may exercise the same rights as are therein provided for the contractor. (As amended by Act approved June 16, 1913, in force July 1, 1913.)

Section 22. **Where Partners Taken in After Contract—Lien for Material Furnished to Sub-Contractor—Lien of Sub-Contractor—Statement of Sub-Contractor to Owner or Contractor—Penalty for Failure to Give Statement.)** Whenever, after a contract has been made, the contractor shall associate one or more persons as partners or joint contractors, in carrying out the same, or any part thereof, the lien for materials or labor furnished by a sub-contractor to such contractor and his partners or associates, as originally agreed upon, shall continue the same as if the sub-contract had been made with all of said partners. When the contractor shall sub-let his contract, or a specified portion thereof, to a sub-contractor, the party furnishing material to or performing labor for such sub-contractor shall have a lien therefor and may enforce his lien in the same manner as is herein provided for the enforcement of liens by sub-contractors. Any sub-contractor shall, as often as requested in writing by the owner or contractor, or the agent of either, make out and give to such owner, contractor or agent, a statement of the persons furnishing material and labor, giving their names and how much, if anything, is due or to become due to each of them, and which statement shall be made under oath if required. If any sub-contractor shall fail to furnish such statement within five (5) days after such demand, he shall forfeit to such owner or contractor the sum of fifty ($50) dollars for every offense, which may be recovered in an action of debt before a justice of the peace, and shall have no right of action against either owner or contractor until he shall furnish such statement, and the lien of such sub-contractor shall be subject to the liens of all other creditors.

Section 23. **Lien Against Fund Due or to Become Due—Contractors for Public Improvements, Notice—Duty and Liability of Officer Notified.)** Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor having a contract for public improvement for any county, township, school district, city or municipality in this State, shall have a lien on the money, bonds or warrants due or to become due such contractor under such contract: Provided such person shall, before payment or delivery thereof is made to such contractor, notify the official or officials of the county, township, school district, city or municipality whose duty it is to pay such contractor of his claim by a written notice; and, provided further, that such lien shall attach only to that portion of such money, bonds or warrants against which no voucher or other evidence of indebtedness has been issued and delivered to the contractor by or on behalf of the county, township, school district, city or municipality, as the case may be, at the time of such notice. It shall be the duty of any such official so notified to withhold a sufficient amount to pay such claim until the same is admitted by the contractor, or adjusted by the agreement of the parties, or there has been an adjudication of the same in a court of competent jurisdiction, and thereupon to pay the amount so determined to be due such claimant, if any, and to that end the said county, township, school district, city or municipality, or any of the other parties interested may institute suit in the same manner as is provided herein in case of privately owned real estate to determine the rights of the parties when such claim is filed.

Any person who shall furnish material, apparatus, fixtures, machinery or labor to any contractor having a contract for public improvement for the State, may have a lien on the money, bonds or warrants due or about to become due such contractor under the contract, by filing with the official whose duty it is to pay such contractor a sworn statement of the claim showing with particularity the several items and the amount claimed to be due on each; but the lien shall attach to only that portion of the money, bonds or warrants against which no voucher or other evidence of indebtedness has been issued and delivered to the contractor by or on behalf of the State.

The person so claiming a lien shall, within thirty (30) days after filing notice with the State official, commence proceedings by bill in equity for an accounting, making the contractor to whom such material, apparatus, fixtures, machinery or labor was furnished, party defendant, and shall, within the same period notify the official of the State of the commencement of such suit by delivering to him a certified copy of the bill filed: provided, that suit shall be commenced and a copy of the bill served upon the State official not less than fifteen (15) days before the date when the appropriation from which such money is to be paid, will lapse. It shall be the duty of the State official after the sworn statement has been filed with him, to withhold payment of a sum sufficient to pay the amount of such claim, for the period limited for the filing of suit, unless otherwise notified by the person claiming the lien.

Upon the expiration of this period the money, bonds or warrants so withheld shall be released for payment to the contractor unless the person claiming the lien shall have instituted proceedings and served the official of the State with the certified copy of the bill as herein provided, in which case, the amount claimed shall be withheld until the final adjudication of the suit is had: Provided, the State official may pay over to the clerk of the court in which such suit is pending, a sum sufficient to pay the amount claimed to abide the result of such suit and be distributed by the clerk according to the decree rendered.

Any payment so made to such claimant or to the clerk of the court shall be a credit on the contract price to be paid to such contractor. Any officer violating the duty hereby imposed upon him shall be liable on his official bond to the claimant serving such notice for the damages resulting from such violation, which may be recovered in an action at law in any court of competent jurisdiction. There shall be no preference between the persons serving such notice, but all shall be paid pro rata in proportion to the amount due under their respective contracts. (As amended by Act approved June 28, 1919.)

Section 24. **Notice to the Owner by Sub-Contractor—Limitation for Service of—May be Served on Owner, Agent, Architect or Superintendent in Charge—Duties and Liabilities of Agents, Architect and Superintendent Notified—Excuse of Notice—Sub-Contractors Protected to Amount Named in—Form of.)** Sub-contractors, or party furnishing labor or materials, may at any time after making his contract with the contractor, and shall within sixty (60) days after the completion thereof; or, if extra or additional work or material is delivered thereafter, within sixty (60) days after the date of completion of such extra or additional work or final delivery of such extra or additional material, cause a written notice of his claim and the amount due or to become due thereunder, to be personally served on the owner or his agent or architect, or the superintendent having charge of the building or improvement: Provided, such notice shall not be necessary, when the sworn statement of the contractor or sub-contractor provided for herein shall serve to give the owner notice of the amount due and to whom due, but where such statement is incorrect as to the amount, the sub-contractor or material man named shall be protected to the extent of the amount named herein as due or to become due to him.

The form of such notice may be as follows: To (name of owner): You are hereby notified that I have been employed by (name of contractor) to (state here what was the contract or what was done, or to be done, or what the claim is for) under his contract with you, on your property at (here given substantial description of the property) and that there was due to me, or is to become due (as the case may be) therefor, the sum of .... dollars.

Dated at .... this........ day of................., A. D.....

Signature.......................

Section 25. **Notice to Non-Resident Owner by Filing Claim with Circuit Court, What Claim Shall Consist of—When Itemized Account Not Necessary.)** In all cases where the owner, agent, architect or superintendent cannot, upon reasonable diligence, be found in the county in which said improvement is made, or shall not reside therein, the sub-contractor or person furnishing materials, fixtures, apparatus, machinery, labor or services may give notice by filing in the office of the clerk of the Circuit Court against the person making the contract and the owner a claim for lien verified by the affidavit of himself, agent or employee, which shall consist of a brief statement of his contract or demand, and the balance due after allowing all credits, and a sufficient correct description of the lot, lots or tract of land to identify the same. An itemized account shall not be necessary.

Section 26. **Lien of Laborers Preferred—Limitation as to Laborer's Notice.)** The claim of any person for wages as a laborer under Sections fifteen, twenty-one and twenty-two of this Act shall be a preferred lien.

Section 27. **Owner's Duty to Retain and Pay Money After Notice—Preference to Laborers—Manner in Which He Shall Make Payment—Liability of Owners.)** When the owner or his agent is notified as provided in this Act, he shall retain from any money due or to become due the contractor, an amount sufficient to pay all demands that are or will become due such sub-contractor, tradesman, materialmen, mechanic or workmen of which claim he is notified, and shall pay over the same to the parties entitled thereto.

Such payments shall be as follows:

First—All claims for wages shall be paid in full.

Second—The claims of tradesmen, materialmen and sub-contractors, who are entitled to liens, pro rata, in proportion to the amount due them respectively. All payments made as directed shall, as between such owner and contractor, be considered the same as if paid to such contractor. Any payment made by the owner to the contractor after such notice, without retaining sufficient money to pay such claims, shall be considered illegal and made in violation of the rights of the laborers and sub-contractors, and the rights of such laborers and sub-contractors to a lien shall not be affected thereby, but the owner shall not be held liable to any laborer and sub-contractor or other person whose name is omitted from the statement provided for in Sections five (5) and twenty-two (22) of this Act, nor for any larger amount than the sum therein named as due such person (provided such omission is not made with the knowledge or collusion of the owner), unless previous thereto or to his payment to his contractor, he shall be notified, as herein provided, by such person of their claim and the true amount thereof.

Third—The balance, if any, to the contractor.

Section 28. **Suits to Enforce Lien by Sub-Contractors—When Can be Brought, Pleadings, Action at Law Against Owner and Contractor—Proceedings, Extent of Owner's Liability.)** If any money due to the laborers or sub-contractor be not paid within ten (10) days after his notice is served, as provided in Sections five (5), twenty-four (24), twenty-five (25) and twenty-seven (27), then such person may either file his petition and enforce his lien as hereinbefore provided for the contractor in Sections nine (9) to twenty (20), inclusive, of this Act, except as to the time within which suit shall be brought, or he may sue the owner and contractor jointly for the amount due him in any court having jurisdiction of the amount claimed to be due, and a personal judgment may be rendered therein, as in other cases. In such actions at law, as in suits to enforce the lien, the owner shall be liable to the plaintiff for no more than the pro rata share that such person would be entitled to with other sub-contractors out of the funds due to the contractor from the owner under the contract between them, except as hereinbefore provided for laborers, and such action at law shall be maintained against the owner only in case the plaintiff establishes his right to the lien. All suits and actions by sub-contractors shall be against both contractor and owner jointly, and no decree or judgment shall be rendered therein until both are duly brought before the court by process of publication, and in all courts, including actions before a justice of the peace and police magistrate, such process may be served and publication made as to all persons except the owners, as in suits in chancery. All such judgments, where the lien is established, shall be against both jointly, but shall be enforced against the owner only to the extent that he is liable under his contract as by this Act provided, and shall recite the date from which the lien thereof attached according to the provisions of Sections one (1) to twenty (20) of this Act, but this shall not preclude a judgment against the contractor personally, where the lien is defeated.

Section 29. **Judgment Before Justice of the Peace—When Transcript of May be Filed—Execution Thereon—Liens Thereof.)** If the execution issued on a judgment obtained before a justice of the peace or police magistrate shall be returned not satisfied, a transcript of such judgment may be taken to the Circuit Court and spread upon the records thereof, and execution issued thereon as in other cases except that the lien of the same shall be preserved as a preferred lien on the property improved from the date recited in the judgment, and enforced thereon the same as if a decree had been rendered by the Circuit Court in a suit to enforce such lien under the provisions of this Act.

Section 30. **Proceedings for General Settlement — Interpleader — How Liens and Claims Cut Off and Judgments Thereon Stayed in Such Proceedings.)** If there are several liens under Sections twenty-one (21) and twenty-two (22) upon the same prem-

ises, and the owner or any person having such a lien shall fear that there is not a sufficient amount coming to the contractor to pay all such liens, such owner or any one or more persons having such lien may file his or their bill or petition in the Circuit Court of the proper county, stating such fact and such other facts as may be sufficient to a full understanding of the rights of the parties. The contractor and all persons having liens upon or who are interested in the premises, so far as the same are known to or can be ascertained by the claimant or petitioner upon diligent inquiry, shall be made parties. Upon the hearing the court shall find the amount coming from the owner to the contractor, and the amount due to each of the persons having liens, and in case the amount found to be coming to the contractor shall be insufficient to discharge all the liens in full, the amount so found in favor of the contractor shall be divided between the persons entitled to such liens pro rata after the payments of all claims for wages in proportion to the amount so found to be due them respectively. If the amount so found to be coming to the contractor shall be sufficient to pay the liens in full, the same shall be so ordered. The premises may be sold as in other cases under this Act. The parties to such suit shall prosecute the same under the requirements as are directed in Section eleven (11) of this Act, and all persons who shall be duly notified of such proceedings and who shall fail to prove their claims, whether the same be in judgment against the owner or not, shall forever lose the benefit of and be precluded from their liens and all claims against the owner. Upon the filing of such bill or petition the court may, on the motion of any person interested, and shall, upon final decree, stay further proceedings upon any suit against the owner on account of such liens, and costs in such cases shall be adjusted as provided for in Section seventeen (17).

Section 31. **Failure to Complete Contract by Contractor—Requisites and Manner of Sub-Contractor's Suit in Case of—Owner's Liability in Case of.)** Should the contractor, for any cause, fail to complete his contract, any person entitled to a lien as aforesaid may file his petition in any court of record against the owner and contractor, setting forth the nature of his claim, the amount due, as near as may be, and the names of the parties employed on such house or other improvements subject to liens; and a notice of such suit shall be served on the persons therein named, and such as shall appear shall have their claim adjudicated. The premises may be sold as in other cases under this Act. The parties to such suit shall prosecute the same under like requirements as are directed in Section eleven (11) of this Act.

Section 32. **Payment of Owner to Contractor—When Wrongful.)** No payments to the contractor or to his order of any money or other considerations due or to become due to the contractor shall be regarded as rightfully made, as against the sub-contractor, laborer or party furnishing labor or materials, if made by the owner without exercising and enforcing the rights and powers conferred upon him in Sections five (5) and twenty-two (22) of this Act.

Section 33. **Limitation as to Suit of Sub-Contractors to Enforce Lien.)** Petition shall be filed or suit commenced to enforce the lien created by Sections twenty-one (21) and twenty-two (22) of this Act within four months after the time of the final payment is due the sub-contractor, laborer or party furnishing material.

Section 34. **General Provisions—Suit to be Commenced or Answer Filed by Lien Claimants, and Within Thirty (30) Days on Demand of Owner, Liener or Interested Party.)** Upon written demand of the owner, liener or any person interested in the real estate, or their agent or attorney, served on the person claiming the lien, or his agent or attorney, requiring suit to be commenced to enforce the lien, or answer to be filed in a pending suit, suit shall be commenced, or answer filed within thirty days thereafter, or the lien shall be commenced or answer filed within thirty days thereafter, or the lien forfeited, and same released if a claim for a lien has been filed with the clerk of the Circuit Court.

Section 35. **Neglect to Satisfy Lien Paid or to Release Where Not Sued on Time—Penalty.)** Whenever a claim for lien has been filed with the clerk of the Circuit Court, either by the contractor or sub-contractor, and is afterward paid with cost of filing same, or where there is a failure to institute suit to enforce the same after demand, as provided in the preceding section, within the time by this Act limited, the person filing the same or someone by him duly authorized in writing so to do shall acknowledge satisfaction or release thereof, in the proper book in such office, in writing on written demand of the owner, and on neglect to do so for ten days after such written demand, he shall forfeit to the owner the sum of twenty-five (25) dollars, which may be recovered in an action of debt before a justice of the peace.

Section 36. **Penalty for Wrongful Sale, Use or Removal of Materials.)** Any owner, contractor, sub-contractor or other person who shall purchase material on credit and represent at the time of purchase that the same are to be used in a designated building or buildings, or other improvement, and shall thereafter sell, use or cause to be used, the said materials in the construction of, or remove the same to any building or improvement other than that designated or dispose of the same for any purpose, without the written consent of the person of whom the materials were purchased, with intent to defraud such person, shall be deemed guilty of a misdemeanor and, on conviction, shall be punished by a fine not exceeding five hundred dollars ($500), or confined in the county jail not exceeding one year, or both so fined and imprisoned.

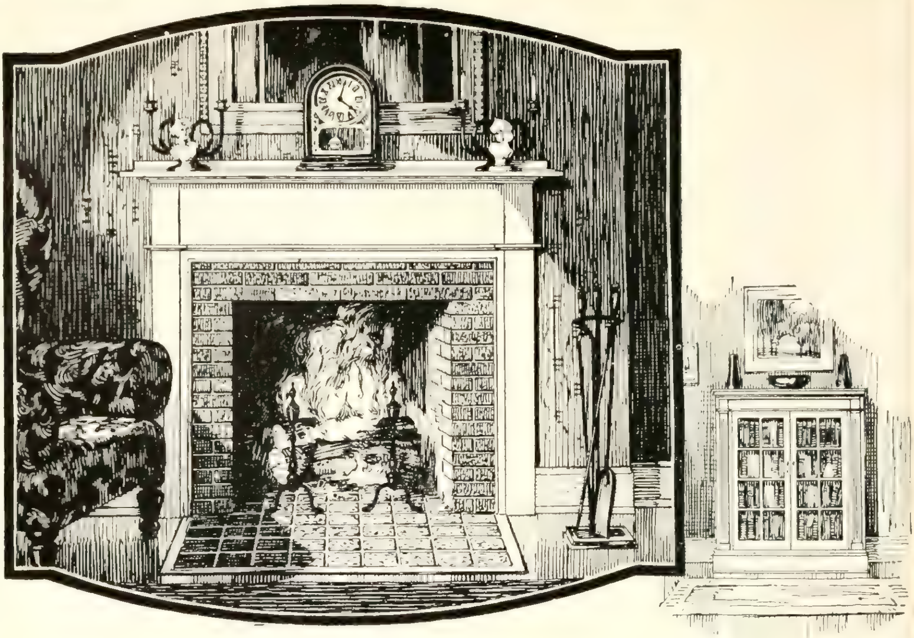
Section 37. **Liens Against Boats, Barges and Water Craft.)** Any architect, contractor, sub-contractor, materialman or other person furnishing services, labor or material for the purpose of or in constructing, building, altering, repairing or ornamenting a boat, barge or other water craft, shall have a lien on such boat, barge or other water craft for the value of such services, labor or material in the same manner as in this Act provided for services, labor or material furnished by such parties for the purpose of building, altering, repairing or ornamenting a house or other building. And such lien may be established and enforced in the same manner as liens are established and enforced under this Act, and the parties shall be held to the same obligations, duties and liabilities as in case of a contract for building, altering, repairing or ornamenting a house or other building.

Section 38. **Circuit Court Clerk's Duties with Regard to Claims Filed—Abstract Fee.)** When claims for liens are filed pursuant to the provisions of Sections seven (7) and twenty-five (25), the clerk of the Circuit Court shall endorse thereon the date of filing, and make an abstract thereof, in a book kept for that purpose and properly indexed, containing the name of the person filing the lien, the amount of the lien, the date of filing, the name of the person against whom the lien is filed, and a description of the property charged with the lien, for which the person filing the lien shall pay one dollar ($1.00) to the Clerk.

Section 39. This Act is and shall be liberally construed as a remedial Act.

Section 40. An Act entitled, "An Act to revise the law in relation to mechanic's liens," approved and in force June 26, 1895, and all other Acts and parts of Acts inconsistent with this Act are hereby repealed: Provided, that this section shall not be construed as to affect any rights existing or actions pending at the time this Act shall take effect.

Hurd's Rev. St. 1916, p. 1655, chap. 82, sec. 15.



INDEX TO BUILDING ORDINANCE

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BUILDING ORDINANCE

OF THE CITY OF CHICAGO

Revised Code of 1922

Comprising Chapter XVII, Sections 396 and 945 of the Chicago Code of 1922.

The Building Code of the City of Chicago has been radically revised and many of the Special Ordinances that were passed within a period of twelve years and known as Special Ordinances and sections that had to do with the Fire and Health Departments were eliminated and placed in those departments. This new arrangement thus afforded an opportunity of changing the plan of publication, as well as a complete change of Section Numbers, which we believe will prove a great benefit to the users of the Handbook.

Particular attention is directed to the numerous Special Rulings of the Department of Buildings on certain disputed sections in the Building Ordinance and which follow at the end thereof.

To eliminate obscurity in the meaning of the ordinances, a plan of illustrating the difficult passages by means of illustrative diagrams has been adopted with the approval of the Commissioner of Buildings. All diagrams used, have been submitted to the commissioner to determine their correctness of interpretation and are published with his sanction.

CHAPTER XVII.

Buildings.

ARTICLE I.

396. **Department of Buildings Established —Officers.)** There is hereby established an executive department of the municipal government of the City of Chicago which shall be known as the Department of Buildings and which shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, a Building Inspector in charge, an Elevator Inspector in charge, a Secretary of the Department of Buildings and such number of assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors, and such other officers, assistants and employees as may be from time to time provided for in the annual appropriation ordinance.

397. **Building Commissioner—Appointment Bond.)** There is hereby created the office of Commissioner of Buildings. He shall be the head of said department of buildings and shall be an experienced architect, or a civil, structural or architectural engineer or a building contractor or an efficient building mechanic and shall have been engaged as an architect or a civil, structural or architectural engineer or building contractor or building mechanic for a period of not less than ten ears prior to his appointment. During his term of office as Commissioner of Buildings he shall not be engaged in any other business.

He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

The Commissioner of Buildings before entering upon the duties of his office shall execute a bond to the city in the sum of twenty-five thousand dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of his duties as the Commissioner of Buildings.

398. **Other Offices.)** There are hereby created the offices of Deputy Commissioner of Buildings, Engineer in Charge, Building Inspector in charge, Elevator Inspector in charge, Fire Escape Inspector in charge, Secretary to the Commissioner of Buildings, Assistant Engineer in charge and the officers of such number of Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors and Fire Escape Inspectors as may from time to time be provided for in the annual appropriation ordinance. The incumbents of these offices shall be known and designated by their respective titles as herein set forth.

399. **Appointment of Subordinates—Duties of Commissioner.)** (a) The Commissioner of Buildings shall have the management and control of all matters and things pertaining to the department of buildings, and shall appoint, and may remove according to law, all subordinate officers and assistants in his department. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said Commissioner.

(b) The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings while in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

(c) It shall be the duty of said commissioner and his assistants to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

400. **Personal Liability.)** In all cases where any action is taken by the Commissioner of Buildings to enforce the provisions of any of the sections contained in this chapter or to enforce the provisions of any of the building ordinances of the city now or at any time hereafter in force, whether such action is taken in pursuance of the

express provisions of such sections or ordinances or in a case where discretionary power is given by the ordinances of said city to the Commissioner of Buildings, such acts shall be done in the name of and on behalf of the City of Chicago, and the said Commissioner of Buildings in so acting for the city shall not render himself liable personally, and he is hereby relieved from all personal liability, for any damage that may accrue to persons or property as a result of any such act permitted in good faith in the discharge of his duties, and any suit brought against the said Commissioner of Buildings by reason thereof shall be defended by the Department of Law of said city until the final termination of the proceedings therein.

401. **Power to Pass On Ordinances.)** The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter, subject to the conditions, modifications and limitations contained therein.

402. **Inspection of Buildings or Structures Where Complaint is Made—Duty of Commissioner—Unlawful to Continue Use of Buildings Not in Compliance with Ordinances.)** It shall be the duty of the Commissioner of Buildings where any citizen represents that any building or structure or part thereof is in an unsafe or dangerous condition, or that the stairways, corridors, exits or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employes in case of fire, panic or accident, or that the stairways, exits and fire escapes of any building or structure in the city do not comply with the requirements of this chapter to make an examination of such building or structure, and if such representation is found to be true the said Commissioner shall give notice in writing to the owner, occupant, lessee or person in possession, charge or control of such building or structure to make such changes, alterations or repairs as safety or the ordinances of the city may require. Upon failure of parties so notified to comply with the requirements of said notice the matter shall be placed in the Department of Law of the City of Chicago for prosecution.

It shall be unlawful to continue the use of such buildings until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make such building or part thereof safe or to bring it into compliance with this Chapter, shall have been made.

403. **Buildings Found in Unsafe Condition—Notice to Owner—Authority of Commissioner.)** (a) Whenever the Commissioner of Buildings shall find any building, or structure or part thereof in the city in such an unsafe condition as to endanger life, but in such condition that by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty, to forthwith notify, in writing, the owner, agent or person in possession, charge or control of such building or structure or part thereof, to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition; such notice shall state briefly the nature of the work required to be done and shall specify the time within which the work required to be done shall be completed by the person, firm or corporation notified, which shall be fixed by said Commissioner of Buildings, upon taking into consideration the condition of such building or structure or part thereof, and the danger to life or property which may result from its unsafe condition.

(b) Whenever such Commissioner of Buildings shall be unable to find the owner of such building, structure or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall address, stamp and mail such notice to such person or persons at their last known address, and in addition thereto shall place or cause to be placed the notice herein provided for upon such building at or near its principal entrance, and shall also post or cause to be posted in a conspicuous place at each entrance to such building, in large letters, a notice as follows:

"THIS BUILDING IS IN A DANGEROUS CONDITION AND HAS BEEN CONDEMNED BY THE COMMISSIONER OF BUILDINGS."

(c) It shall be unlawful for any person, firm or corporation to remove said notice or notices without written permission from the Commissioner of Buildings.

(d) If at the expiration of the time specified in such notice for the completion of the work required to be done by the terms of such notice, in order to render the building or structure safe, said notice shall not have been complied with, and said building or structure is in such an unsafe condition as to endanger life or property, it shall be the duty of the Commissioner of Buildings to proceed forthwith to tear down or destroy that part of said building or structure that is in such unsafe condition as to endanger life or property, and in cases where an unsafe building or structure cannot be repaired or rendered safe by the application of precautionary measures, such building or structure, or the dangerous parts thereof, shall be torn down by said Commissioner of Buildings or by his order and the expense of tearing down any part of such building or structure shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the said commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control thereof the cost of doing such work, by legal proceedings prosecuted by the Law Department.

(e) If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said commissioner within the time specified in such notice, in such case, at the expiration of such time it shall be unlawful for any person, firm or corporation to occupy or use said building or structure, or any part thereof, until said building or structure or part thereof is placed in a safe condition; and in case where a building or structure, or part thereof, is in a dangerous or unsafe condition and has not been placed in a safe condition within the time specified in the notice of the Commissioner of Buildings, such building or structure, or such part thereof, shall be forthwith vacated, and it shall be unlawful for any person or persons to enter same except for the purpose of making repairs required by the Commissioner of Buildings and the ordinances of the City of Chicago.

404. **Building or Part of Building Constructed or Being Constructed in Violation of Chapter—Authority of Commissioner to Tear Down.)** (a) Whenever it shall be found that any building or structure, or part thereof, is being, or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is

being, constructed or erected contrary to the provisions of this chapter and shall specify briefly in such notice in what manner the provisions of this chapter or any of them, have been violated, and shall require the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in such notice the time within which such work shall be done.

(b) If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this chapter, the Commissioner of Buildings shall have the authority, and it shall be his duty to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building of structure is being erected, in legal proceedings prosecuted by the Department of Law.

405. **May Direct Fire Department to Remove.)** The Commissioner of Buildings shall have authority to direct the Fire Marshal to tear down any defective or dangerous wall or structure or any building or structure or part thereof which may be constructed in violation of the terms of this chapter, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, directing him or them to tear down or remove any defective wall, building or structure, or any part thereof, which is in a dangerous condition, which has been, or is being, constructed or maintained in violation of the terms of this chapter. In case of the destruction or partial destruction of buildings by fire, decay or otherwise, when any department of the city government, pursuant to the ordinances of the city, shall make an outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of such building or buildings, or structure, or for the preservation of life of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or its or their agent or agents, and it shall be the duty of said Commissioner of Buildings to refuse to issue a permit for the construction, re-construction, alteration or repair of any building or buildings or structure by any such owner or owners, lessee, occupant, agent or person in possession, charge or control thereof until such outlay or expenditure shall be repaid to the city by the owner, lessee, occupant, agent or person in possession, charge or control of such building or buildings thus totally or partially destroyed in the manner aforesaid. Said commissioner shall also proceed forthwith to collect the amount of such bill from such owner or owners, by legal proceedings prosecuted by the Department of Law.

406. **May Stop Construction and Wrecking of Buildings.)** (a) Said commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner, or with defective material, or in violation of any ordinance, and to order, in writing or by parol, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

(b) And the said commissioner shall have power to stop the wrecking or tearing down of any building or structure within said city when the same is being done in a reckless or careless manner or in violation of any ordinance or in such a manner as to endanger life or property, and to order any and all persons engaged in said work to stop and desist therefrom. When such work has been stopped by the order of said commissioner, it shall not be resumed until said commissioner shall be satisfied that adequate precautions will be taken for the protection of life and property, and that said work will be prosecuted carefully and in conformity with the ordinances of the city.

407. **Arbitration—Appeal from Decision.)** (a) In all cases where discretionary power is given to the Commissioner of Buildings to estimate damage to buildings, as also in questions relating to the security of any building or buildings or structures, or part thereof, and in all other cases where discretionary powers are given by ordinance to the Commissioner of Buildings, any party or parties believing themselves injured or wronged by the decision of the Commissioner of Buildings may before instituting any suit, make an appeal for arbitration as follows, to-wit:

(b) Any person wishing to make an appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to any arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

(c) The Commissioner of Buildings shall thereupon inform the appellant of the cost of such arbitration and such appellant shall, within twenty-four hours from the receipt of such information, deposit with the Commissioner of Buildings the sum of money requested for defraying the expense of the same, which sum shall be fixed in each case by said commissioner in proportion to the time it will take and the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him, the Commissioner of Buildings shall appoint an arbitrator to represent the city and the two arbitrators thus chosen shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation and consideration of the matter in question, be final and binding upon the appellant as well as the city unless an appeal is taken therefrom, as provided in case of an appeal under a statutory arbitration, within five days thereafter.

408. **Arbitrators to Take Oath—Power to Examine Witnesses.)** The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath by the City Clerk, to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing, both to the Commissioner of Buildings and to the appellant. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report and shall be in full of all

costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the aforesaid appellant shall be returned to him and the entire cost of such arbitration shall be paid by the city.

409. **In Urgent Cases—Commissioner's Power Final.)** Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case which is so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

410. **Duty of Police to Assist Commissioner in Enforcing Provisions of this Chapter.)** Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said department, when called upon by said commissioner, to act according to the instructions of, and to perform such duties as may be required by said commissioner in order to enforce or put into effect the provisions of this chapter.

411. **Certificates—Notices—Register.)** (a) The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from the Department of Buildings and shall keep a record of the same, and shall issue or cause to be issued all permits authorized by this chapter.

(b) He shall also keep a proper record of all transactions and operations of the department and such record shall be at all times open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Marshal and members of the City Council.

412. **Must Keep Account of Fees Paid—Annual Reports and Estimates.)** (a) Said commissioner shall keep in proper books for that purpose an accurate account of all fees charged, giving the name of person to whom same is charged, date on which said charge is made, and the amount of each such fee.

(b) He shall also, annually, on or before the first day of March in each year prepare and present to the City Council a report showing the receipts and expenditures and entire work of the Department of Buildings during the previous fiscal year and he shall on or before November first of each year prepare and submit to the Comptroller an estimate of the whole cost and expense of providing for and maintaining his office during the ensuing fiscal year.

413. **Examination and Approval of Plans—Record of Inspections and Complaints.)** The Commissioner of Buildings and his assistants shall pass upon all questions relating to the strength and durability of buildings or structures; shall examine and approve all plans before a permit is issued for the construction of any building or structure. The Commissioner of Buildings shall cause to be kept a complete record showing the location and character of every building or other structure for which a permit is issued and shall cause to be filed every report of inspection made on such building, which reports shall bear the signatures of the inspectors making such inspections. He shall cause a record to be kept of all complaints of violations of the building laws and shall cause all such complaints to be investigated.

414. **Deputy Commissioner of Buildings—** There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this office shall be either a civil, structural or architectural engineer or an architect, an experienced building contractor or an efficient building mechanic with at least five years' experience and training.

415. **Deputy Commissioner of Buildings—Duties.)** (a) The Deputy Commissioner of Buildings shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office and while so acting shall discharge all the duties and possess all the powers imposed upon or vested in the Commissioner of Buildings.

(b) The deputy commissioner of buildings shall, under the direction of the Commissioner of Buildings, have general control of all matters and things pertaining to the work of the Department of Buildings and shall perform such other duties as may be required of him by the Commissioner of Buildings.

416. **Engineering Staff.)** The Commissioner of Buildings shall appoint according to law at least four Architectural Engineers, and such other engineers and assistants as the City Council may by ordinance provide, for service on the engineering staff of the Department of Buildings. Every person certified to fill the position of Architectural Engineer shall be a civil, structural or architectural engineer of at least five years' training and experience.

417. **Architectural Engineers — Duties.)** The Arcitectural Engineers shall, under the direction of the Commissioner of Buildings, examine all plans submitted for the purpose of obtaining a permit. They shall also examine and verify the figures on all floor load placards before such placards are approved for posting. They shall, in addition thereto, perform such other duties as may be required of them by the Commissioner of Buildings.

418. **Building Inspector in Charge—Duties.)** (a) There is hereby created the office of Building Inspector in charge of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, architectural or fire protection engineer, or an architect, or building superintendent or a building mechanic, with at least five years' experience in general building construction.

(b) In the absence of the Commissioner of Buildings and the Deputy Commissioner of Buildings from their offices the Building Inspector in Charge shall act as Commissioner of Buildings, and while so acting he shall discharge all of the duties and possess all of the powers imposed upon or vested in the Commissioner of Buildings.

(c) He shall have immediate charge of the periodical inspection of buildings and of the inspection of buildings and structures being erected, enlarged, altered or repaired, excepting only such inspection as is expressly assigned to the elevator or fire-escape inspectors or is by law assigned to some other department of the city government.

419. **Assistant Building Inspectors In Charge.)** (a) The Commissioner of Buildings shall appoint, according to law, at least four Assistant Building Inspectors in Charge.

(b) Every person certified to fill the position of Assistant Building Inspector in Charge shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Assistant Building Inspectors in Charge shall have immediate charge of the several

districts assigned to them by the Commissioner of Buildings and shall perform such other duties as the Commissioner of Buildings shall require them.

420. **Building Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Building Inspectors as may be necessary.

(b) Every person certified to fill the position of Building Inspector shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Building Inspectors shall, under the direction of the Building Inspector in Charge, examine all buildings and structures in the course of erection, enlargement, alteration, repair or removal, as often as is required for efficient supervision, and shall make such periodical examinations of existing structures as shall be assigned to them. They shall examine all buildings, structures and walls reported to be in dangerous condition. They shall examine all buildings and other structures for the enlarging, altering, raising or removing of which, application for permit shall be made.

(c) Every building inspector shall make written reports daily to the Commissioner of Buildings as to the condition in which he found each building examined and as to violations, if any, of the ordinances which the Commissioner of Buildings is required to enforce, together with the street and number of the premises where such violations, if any, were found, the names of the owner, agent, lessee and occupant thereof, and of the architect and the contractor engaged in and about the work in question. The Building Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

421. **Elevator Inspector in Charge.)** (a) There is hereby created the office of Elevator Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Elevator Inspector in Charge, shall be a graduate in engineering from a recognized technical school, shall be versed in the essentials of both mechanical and electrical engineering and shall have had at least five years experience in shop or construction work.

422. **Duties of Elevator Inspector in Charge.)** The Elevator Inspector in Charge shall examine all plans for the installation of elevators and for the installation of mechanical devices and apparatus in theaters, amusement parks and the like, and, no such elevator, mechanical device or apparatus shall be installed or operated without the approval of the Elevator Inspector in Charge. The Elevator Inspector in Charge shall cause such inspection to be made of all new installations, as may be necessary to insure the carrying out of the approved plans and shall cause such periodic inspection to be made of existing installations of such mechanisms, devices and apparatus, as may be required by the Commissioner of Buildings, and shall perform such other duties as may be required of him by the Commissioner of Buildings.

423. **Elevator Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Elevator Inspectors as may be necessary.

(b) Every person certified to fill the position of Elevator Inspector shall be a mechanical engineer, machinist or elevator builder, and shall be well grounded in the rudiments of mechanical and electrical engineering.

424. **Duties of Elevator Inspectors.)** The Elevator Inspectors shall inspect all elevators and such other mechanisms, devices and apparatus as shall be assigned to them by the Elevator Inspector in Charge, both existing and in process of being erected or installed, together with all the equipment and enclosures thereof. They shall make written reports daily to the Commissioner of Buildings as to the condition in which they find the elevators, equipment, enclosures, mechanisms, devices and apparatus, inspected by them, and of any violations of the requirements of this Chapter pertaining to such matters, together with the street and number of the premises where such violations, if any, occur, the names of the owner, agent, lessee and occupant thereof, and of the architect and contractor engaged in or about the construction and installation of such elevators, equipment, enclosures, mechanisms, devices or apparatus. They shall perform such other duties as may be required of them by the Commissioner of Buildings.

425. **Secretary—Duties.)** (a) There is hereby created the office of Secretary of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law.

(b) The Secretary to the Commissioner of Buildings shall, under the supervision and direction of the Commissioner of Buildings, preserve and keep all books, records and papers belonging to the office of the Department of Buildings or which are required by law to be filed therein. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

426. **Clerical Assistants.)** The Commissioner of Buildings shall appoint according to law, such clerical assistants, stenographers and messengers and other employees as may be provided for by the city council as may be necessary; and they shall perform such duties as may be required of them by the Commissioner of Buildings.

427. **Bonds.)** The deputy commissioner of buildings, the building inspector in charge, the assistant building inspector in charge, the elevator inspector in charge and the architectural engineers shall, before entering upon the duties of their offices or positions, each execute a bond running to the city of Chicago, conditioned for the faithful performance of their duties, with such sureties as the city council shall approve in the following sums: the deputy commissioner of buildings, ten thousand dollars; the building inspector in charge, the assistant building inspector in charge, the elevator inspector in charge, and the architectural engineers, five thousand dollars each.

428. **Employees Not to Engage in Another Business.)** Every employee in the Department of Buildings shall devote his entire time to such employment and shall not be engaged in any other business or vocation.

429. **Power of Entry.)** The Commissioner of Buildings and his Assistants are empowered to enter any building or structure or premises, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed and maintained in accordance with the provisions of this chapter and it shall be unlawful to exclude them from any such building, structure or premises.

ARTICLE II.

Permits, Plans and Fees

430. **Permits—When Required—Limitations of Time For.)** Before proceeding with the erection, enlargement, alteration, repair or removal of any building or structure in the city, a permit for such erection, enlargement, alteration, repair or removal

shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of any building or of any structural part thereof within the city unless such permit shall have first been obtained from the Commissioner of Buildings. And if after such permit shall have been granted, the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time, then such permit shall be void, and no operations thereunder shall be begun or completed until an extended permit shall be taken out by the owner or his agent, and a fee of twenty-five per cent. of the original cost of permit shall be charged for such extended permit, provided, however, that in no case shall a permit be issued or renewed for a less fee than two dollars.

431. **Permits—Application For.** Application for building permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made, plans in conformity with the provisions of this chapter which have been examined and approved by the Commissioner of Buildings and his assistants, as hereinbefore provided for, shall be filed with the Commissioner of Buildings. He shall then issue a permit, and shall file such application, and shall apply to such plans a final official stamp, stating that the drawings to which the same has been applied comply with the terms of this chapter. The plans so stamped shall then be returned to such applicant. True copies of so much of such plans as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings, and shall remain on file in his office for a period of six months after the occupation of such building, after which such drawings shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him, upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than six month after the occupation of the building to which they relate.

432. **Approval of Plans by Other Departments.)** All plans and drawings for the construction or alteration of any building or other structure for which building permits are required shall, before such permits are issued, be presented to the Commissioner of Health for examination and approval as to the proposed plan for the ventilation of rooms, light and air shafts, windows, the ventilation of water closets, drainage and plumbing. They shall also be presented to the Chief of Fire Prevention and Public Safety for examination and approval with regard to such ordinances as are within the duty of such office to enforce. They shall also be presented to the Boiler Inspector and the Smoke Inspector in all cases where permits from these departments are required to be procured by the ordinances of the City.

433. **Issuance of Permits.)** All plans and drawings for the construction or alteration of any building or other structure for which a building permit is required may, at the option of the applicant for a building permit and by payment of a fee of one dollar for each plan, be filed in the office of the Commissioner of Buildings, and a receipt or check will be given for said plans which must be presented for the return of same after they have been examined and passed upon. The Commissioner of Buildings shall appoint a clerk with such necessary assistants whose duty it shall be, under the direction of the Commissioner of Buildings, to receive, take charge of and return all plans and drawings filed as aforesaid. Every plan or drawing so filed in the office of the Commissioner of Buildings shall be forwarded by him successively to the Department of Smoke Inspection, the Department of Boiler Inspection, the Department of Public Works, the Bureau of Fire Prevention and Public Safety, and the Sanitary Bureau, and there submitted to the proper officials of these

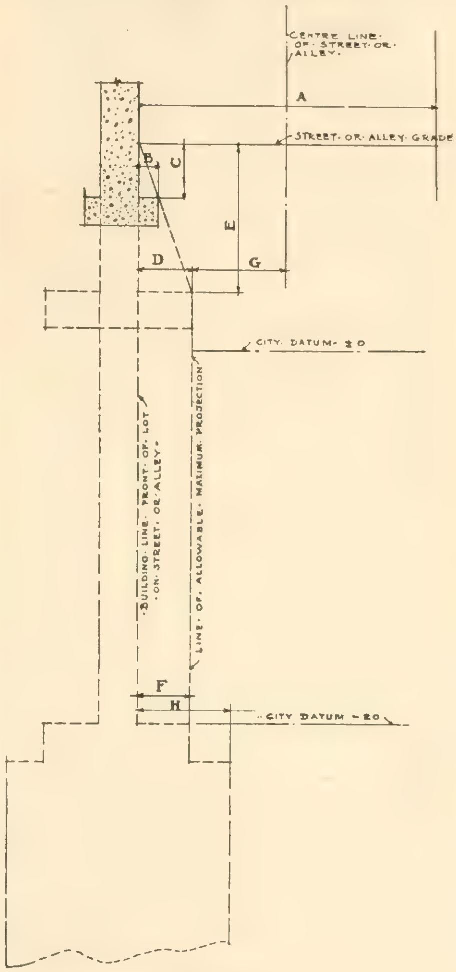

Fig. 1.

FOUNDATIONS.
See Section 436.

(A) Width of street.
Provision made for 16′ 0″ or over.
Provision made for less than 16′ 0″.
(B) Allowable projection.
A ratio of 4½″ to every foot of (C).
(C) Depth of foundation below inside sidewalk grade or alley grade—See (B).
(D) Maximum allowable projection at point (E) 8′ 0″ below said sidewalk or alley grade = 3′ 0″.
(E) Point at depth of formation (8′ 0″) below sidewalk or alley grade where maximum projection begins. See (D).
(F) Allowable maximum projection from (E) to 20′ 0″ below plus or minus 0 city datum = 3′ 0″.
(G) For streets, alleys, etc., less than 16′ 0″ in width. Foundations may not be built nearer than (G) 5′ 0″ to middle line of streets or alleys, etc.
(H) Allowable projection below 20′ 0″ city datum to be determined so far as in the opinion of the Commissioner of Buildings is necessary.

respective departments and bureaus for examination and approval, and after said plans have been examined and passed upon, the Commissioner of Buildings shall cause said plans or drawings to be returned to his office where they shall be taken up for examination and approval by the Commissioner of Buildings. At the proper time notice shall be given by the Commissioner of Buildings to the applicant that his plans have been examined and are ready to be returned to him, and if such plans have been approved as submitted by the various departments and bureaus as aforesaid, the Commissioner of Buildings then shall, according to ordinance, issue a permit for the construction or erection of such building or structure.

434. **Encroachment on Public Highway.)** The Commissioner of Buildings shall not issue any permit authorizing the construction, erection repair or alteration of any building or structure unless the plans submitted for his approval clearly show that such building or structure with all its appurtenances, foundations and attachments can be erected entirely within the limits of the lot or tract of land upon which it is proposed to erect such building or structure, except as hereinafter provided, and except as otherwise provided by the ordinances of the City of Chicago, and no permit to erect, repair or alter any building or structure shall authorize the use of any part of any public highway or other public ground for the construction or maintenance of such building or structure except as hereinafter provided, and except as otherwise provided by the ordinances of the City of Chicago, nor shall any permit be issued for the construction or maintenance of any balcony or canopy extending over any public highway or other public ground unless permits therefor have been obtained from the proper department of the City Government, pursuant to an ordinance, specifically authorizing the same. The plans of every building or structure which show that any part of said building or structure or any of its appurtenances, or attachments thereto, extend over any part of any public highway or other public ground than hereinafter provided for shall, previous to being submitted to the Commissioner of Buildings, be submitted to the Commissioner of Public Works and notice thereby given to him of the proposed encroachment upon any public highway or other public ground. Proof of such notice to the Commissioner of Public Works must accompany plans when same are presented to the Commissioner of Buildings.

435. **Cornices and Belt Courses.)** The Commissioner of Buildings may issue permits for the horizontal cornices and belt courses so called to be constructed on buildings as follows:

Where all parts of a cornice of any building or structure are more than twelve feet above the inside grade of the sidewalk, and in cases where the sidewalk grade varies, are more than twelve feet above the average or mean inside grade of the sidewalk and where such cornice extends in whole or in part along the street frontage, of a building, and where the return of such cornice if any along an alley wall is not longer than a distance equal to the width of the alley, such cornice may project into the street or alley a distance of twenty-four inches. For each additional one foot in height such cornice is placed above the height of twelve feet as aforesaid up to the limits of height fixed by ordinances for the particular building of which such cornice is a part, such cornice may project into the street or alley an additional one-quarter inch, until the total projection has reached the maximum of four feet six inches where the width of the street is less than sixty-six feet and to a maximum of five feet where the width of the street is sixty-six feet or more.

Horizontal belt courses, water tables and other horizontal architectural features, which do not add floor area to a building or structure and which extend in whole or in part along the street frontage of a building with a return if any around an alley wall not longer than a distance equal to the width of the alley, and where all parts of such horizontal belt courses, water tables and other horizontal architectural features are more than twelve feet above the inside grade of the sidewalk, may project into the street or alley a distance not to exceed eighteen inches.

436. **Encroaching Foundations.)** The Commissioner of Buildings may issue permits for buildings for which it is contemplated that there shall be projections of the foundation, or a part or parts thereof, into a public street, a public alley or a public thoroughfare under the following conditions: Where such street, alley or thoroughfare is sixteen (16) feet or more in width such foundations shall have no projection at the sidewalk or alley grade, but may project at the ratio of four and one-half (4½) inches to one (1) foot for each one (1) foot of depth such foundation may extend below the sidewalk or alley grade to a maximum projection of thirty-six (36) inches at a depth eight (8) feet below said sidewalk or alley grade, and such foundations, or such part or parts thereof, which are higher than a point twenty (20) feet below city datum and are lower than a point eight (8) feet below the sidewalk or alley grade, may project into such street, alley or thoroughfare for a distance not to exceed thirty-six (36) inches for such part of their extent as is included between a point eight (8) feet below the said sidewalk or alley grade and a point twenty (20) feet below said city datum, and, where said street, alley or thoroughfare is less than sixteen (16) feet in width, foundations, or any part or parts thereof, may project into such street, alley or thoroughfare at a ratio of four and one-half (4½) inches of projection to one (1) foot of depth, but no foundation, or part or parts thereof, shall be built nearer than five (5) feet to the middle line of such street, alley or thoroughfare. No foundation, or any part or parts thereof, shall project into a public street, a public alley or a public thoroughfare in such manner as to add area to the superstructure of any building or structure.

The construction of caisson and other types of foundations, part or parts of which may extend to a greater depth than twenty (20) feet below city datum, shall conform to the requirements of this section as hereinbefore contained in such part or parts as are higher than twenty (20) feet below city datum and lower than eight (8) feet below the sidewalk or alley grade and in such part or parts as are higher than eight (8) feet below the sidewalk or alley grade, but such part or parts of such last mentioned foundations as are constructed lower than twenty (20) feet below city datum may project into a public street, a public alley or a public thoroughfare so far as, in the opinion of the Commissioner of Buildings, is necessary for the stability of the building or structure of which they are a part.

It is expressly made a condition in the issuance of any permit for the construction of a building or structure whose foundations, or any part or parts thereof, project into a public street, a public alley or a public thoroughfare at any point higher than twenty (20) feet below city datum that if during the construction of or after the completion of such structure or building the said foundation or any part or parts thereof, shall project in such a manner as to interfere with or be an obstruction to the building of, maintaining, conducting or

operating any public utility now or hereafter to be constructed, or any part or parts of any construction in connection therewith, that such projecting foundations, projecting part or projecting parts thereof, shall be subject to removal upon notice from the Commissioner of Public Works so to remove them. Such notice shall be in writing and shall allow such length of time as said Commissioner of Public Works shall deem a reasonable time for the purpose of making the changes required thereunder, but the owner or owners of the said building or structure shall proceed at once upon receipt of said notice to remove all projecting part or parts of such foundations without any expense, loss or damage accruing to the City of Chicago. Upon failure of such owner or owners to comply with said notice by beginning the work required thereunder within thirty (30) days after the receipt of such notice or upon failure to complete same within such reasonable time thereafter as the Commissioner of Public Works shall deem sufficient, the Commissioner of Public Works may proceed at once to remove such projecting part or parts of such foundations and the City of Chicago may recover the cost and expense of such removal, unless otherwise reimbursed, by an action at law against the owner or owners, lessee or lessees of said promises.

437. **Additional Plans Showing Projections —Structure with Foundation Below Minus 40 City Datum.)** In addition to the general plan of the building or structure as required in other sections of this ordinance, a detailed plan drawn to a large scale of any proposed cornice or any projection contemplated in the two preceding sections shall be submitted to the Commissioner of Buildings for his examination and approval.

Whenever application is made for a permit to erect any building or structure, the foundations of which are designed to extend to an elevation of minus 40 Chicago datum, the plans of said building or structure shall be submitted to the City Engineer and his approval secured before a permit is issued for the erection of such building or structure by the Commissioner of Buildings; provided, however, that this requirement shall only apply within the district bounded as follows: starting at the intersection of the center line of east 12th street produced and the shore of Lake Michigan, thence west along the center line of east and west 12th street to the intersection of the center line of South Halsted street, thence north along the center line of South and North Halsted street to the intersection of the center line of West Chicago avenue, thence east along the center line of West and East Chicago avenue and East Chicago avenue produced to the shore of Lake Michigan, then southeasterly along the shore of Lake Michigan to the place of beginning; and, provided further, that this restricted provision shall apply to all buildings or structures designed to be erected at any location within the city when the nearest point on any of said proposed buildings or structures is within two hundred feet of the shore line of Lake Michigan, the Chicago River or any of its branches, the Drainage Canal, Lake Calumet or the Calumet River.

438. **Plans to be Kept on Work.)** In all cases the approved plan, together with building permits, must be kept on the job while the work is in progress.

439. **Plans—Essentials of.)** All plans and drawings for buildings or for structures other than buildings shall be presented to the Commissioner of Buildings for his approval, and each set of plans presented shall be approved by the Commissioner of Buildings before a permit will be granted. All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the lot lines and the entire sewerage and drain pipes and the location of all plumbing fixtures within such building or structure. No permit shall be granted or plans approved unless such plans are signed and sealed either by an architect licensed to practice architecture under "The Illinois Architectural Act," or by a structural engineer licensed to practice structural engineering under "The Illinois Structural Engineering Act."

440. **Plans—Alterations Upon Stamped Plans Not Permitted—Certain Alterations Excepted.)** It shall be unlawful to erase, alter or modify any lines, figures, or coloring contained upon such drawings so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, or drawing, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made; but alterations in buildings which do not involve any change in their structural parts or of their stair ways, elevators, fire-escapes or other means of communication, or ingress or egress, or in lighting or ventilation and that are not in violation of any of the provisions of this chapter, may be made without the permission of the Commissioner of Buildings.

441. **Deposit With Water Department—How Made—Indemnity Bonds—Fees for Water Used.)** (a) Before the Commissioner of Buildings issues a permit as provided herein, he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a water meter for measuring all the water to be used in the construction of such building in accordance with the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the city an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts and to the city and to any person in consequence, or by reason of, the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

(b) The fees to be paid for water used in connection with the erection of buildings shall be as follows, to-wit:

At the rate of five cents for every one thousand bricks, wall measure, used in connection therewith.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith.

At the rate of five cents for every one hundred cubic feet of hollow tile arch, partition or fireproof covering used in connection therewith.

442. **Amount of Permit Fees.)** (a) The fees to be charged for building permits shall be as follows: For sheds not exceeding three hundred square feet in area, two dollars; for open shelter sheds, at the rate of two dollars for each one thousand cubic feet or fractional part thereof; for all buildings or other

structures, other than sheds and open shelter sheds, as hereinafter described, the fee for the permit shall be at the rate of twenty cents for every one thousand cubic feet or fractional part thereof for buildings containing not to exceed two hundred thousand cubic feet of volume. For buildings exceeding two hundred thousand cubic feet in volume twenty cents per cubic feet for the first two hundred thousand cubic feet and forty cents per one thousand cubic feet for each additional one thousand cubic feet of volume or fractional part, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof, and to include all bay windows and other projections; but in no case shall any permit be issued for a less fee than two dollars, except that a fee of two dollars shall be charged for recovering or recoating the roof of any building.

(b) The fee to be charged for permits issued for alterations and repairs in or to any building or other structure shall be based on the cost of such alterations and repairs and shall be at the rate of two dollars for the first one thousand dollars, or part thereof, and one dollar additional for each one thousand dollars or part thereof to be expended therefor. The fee for permit to raise any building other than a frame building shall be for raising, shoring up, underpinning or moving any building other than a frame building ten cents per one thousand cubic feet of volume or fractional part thereof: Provided, however, that in no case shall a permit be issued for a less fee than five dollars.

(c) In addition to the above permit fees for buildings, permit and inspection fee shall be charged as follows:

For erection of fire-escape, four dollars minimum to include fire-escapes up to four stories in height; and fifty cents additional for each story above four stories in height;

For installation or alteration of elevator, five dollars;

For semi-annual inspection of elevator, four dollars;

For erection of billboards or signboards, five dollars; for every twenty-five lineal feet or fractional part thereof;

For erection of illuminated and other roof signs under Section 919 of this chapter, fifty dollars for the first five hundred square feet of superficial area or fractional part thereof and five cents for each additional square foot area;

For annual inspection of billboard or signboard, one dollar for every twenty-five lineal feet of billboard or signboard or fractional part thereof;

For annual inspection of illuminated and other roof signs under Section 919, fifty dollars for the first five hundred square feet or fractional part thereof, five cents additional for each additional square foot area;

For annual inspection of building required by Section 445 of this chapter, three dollars for each twenty-five thousand square feet or fractional part thereof;

For semi-annual inspection of iron or steel curtain, ten dollars;

For semi-annual inspection of asbestos curtain, five dollars;

For permit for tank on roof or tower in excess of four hundred gallon capacity, five dollars;

For permit for isolated chimneys or for chimneys extending over fifty feet above the roof of any building, five dollars;

443. **Permit for Wrecking Building—Bond.)** (a) Before proceeding with the wrecking or tearing down of any building or other structure more than one story in height, a permit for such wrecking or tearing down shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the wrecking or tearing down of any building or structure or any structural part of such building or structure unless such permit shall first have been obtained. Application for such permit shall be made by such owner or his agent to the Commissioner of Buildings, who shall issue such permit upon such application and the payment of the fee herein provided for. Such application shall state the location and describe the building which it is proposed to wreck or tear down. The fee for such permit shall be five ($5.00) dollars for every twenty-five feet, or fractional part thereof, of frontage. Upon the issuance of such permit, such building may be wrecked or torn down, provided that all the work done thereunder shall be subject to the supervision of the Commissioner of Buildings and to such reasonable restrictions as he may impose in regard to elements of safety and health, and provided, further, that the work shall be kept sprinkled and sufficient scaffolding be provided to insure safety to human life, and to comply with the Provisions of the Act of the General Assembly Passed June 3, 1907, in force July 1, 1907 Providing for the safety of workmen in and about the construction and removal of buildings.

(b) Before any permit is issued granting authority to wreck a building or structure for which such permit is required, the person, firm or corporation engaged in the work of wrecking same shall file with the City Clerk a bond with sureties to be approved by the City Comptroller to indemnify, keep and save harmless the City against any loss, cost, damage, expense judgment or liability of any kind whatsoever which the City may suffer, or whicl may accrue against, be charged to or b recovered from said City, or any of it officials, from or by reason or on accoun of accidents to persons or property durin any such wrecking operations, and from o by reason or on account of anything don under or by virtue of any permit grante for any such wrecking operations. Suc bond in each case shall extend to and cove all such wrecking operations carried o through permits obtained thereunder b such person, firm or corporation during an fiscal year beginning January first and ending December thirty-first, and no permi shall be issued for any wrecking work except as hereinbefore otherwise provide during such fiscal year until such bond i filed. Said bond shall be in the penal sur of twenty thousand dollars for all wreckin operations on such buildings and othe structures not more than three stories i height, and there shall be an additional bon filed in the penal sum of twenty thousan dollars or a bond in the penal sum o forty thousand dollars shall be filed in th first instance in case of wrecking operation on buildings and other structures four o more stories in height. Upon the filing c such bond or bonds the person, firm or cor poration engaged in the work of wreckin such buildings and other structures ma obtain permits for such wrecking operation as are authorized under the said bond c bonds as hereinabove provided for durin the fiscal year in which the same is or ar filed: Provided, that, in case of accident c casualty in the progress of any wreckin operations carried on under any permit s issued, or the happening of any circum stance which might in the opinion of th Commissioner of Buildings render such bon or bonds inadequate, the said Commissione may, in his discretion, require such ad ditional bond as he may deem necessary t fully protect the city from loss resultin from the issuance of such permits befor he allows the work to proceed or before an additional permits are issued by him.

444. **Permit—Revocation of.)** If th work in, upon or about any building c structure shall be conducted in violation c any of the provisions of this chapter, i shall be the duty of the Commissioner c Buildings to revoke the permit for th

building or wrecking operations in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building or wrecking operations unless such permit shall first have been re-instated or re-issued by the Commissioner of Buildings. Before a permit so revoked may be lawfully re-issued or re-instated, the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such building.

445. **Annual Inspection of Buildings—Stairways and Means of Egress—Inspection Fee.)** (a) The Commissioner of Buildings and his assistants shall make an annual inspection of all theaters and places of amusement, worship, instruction or entertainment, and also of all other buildings over two stories in height, except residences, and except buildings in which automobiles are housed, and except tenements three stories or less in height. It shall be the duty of every owner, agent, lessee or occupant of any such building as is referred to in this section and of the person in charge or control of same to permit the making of such annual inspection by the Commissioner of Buildings, or by a duly authorized Building Inspector, at any time upon demand being duly made.

(b) Whenever any such inspection shows the building to be in compliance with the requirements of this Chapter with respect to stairways, means of egress, and in all other respects, it shall be the duty of the Commissioner of Buildings to issue, or cause to be issued, a certificate setting forth the result of such inspection, containing the date thereof, and a statement to the effect that such building complies in all respects with the provisions of this Chapter, upon the payment of the inspection fee herein required.

(c) It shall be the joint and several duty of the owner, agent, lessee or occupant of the building so inspected and of each and every person in charge and control of the same to frame the said certificate and place it in a conspicuous place near the main entrance of such building.

(d) It shall be the joint and several duty of the owner, agent, lessee or occupant of every building described in this section to provide a typical floor plan of such building reproduced on a sheet eight by ten inches in size. Said plan shall be drawn on as large a scale as will be practicable on such sheet, and said sheet shall also state the street address of such building, and shall give the class of the building, the kind of construction used therein, the height and number of stories contained therein and the nature of the occupancy.

(e) It shall also be the joint and several duty of such owner, agent, lessee or occupant to deliver a copy of said sheet to the Commissioner of Buildings and to frame a copy of said sheet and place the same near the framed certificate hereinabove required.

(f) It shall also be the joint and several duty of the said owner, agent, lessee or occupant to substitute a new sheet for the sheet on file with the Commissioner of Buildings, and also the sheet framed as above required, whenever such changes or alterations are made in such building as will affect the substantial accuracy of the sheet previously furnished such Commissioner and framed as above required.

(g) Where the result of such inspection shall show that such building fails in any respect to comply with the requirements of this Chapter, it shall be the duty of the Commissioner of Buildings to notify the owner, agent, lessee or occupant of such building to this effect and to specify wherein such building fails to comply with the requirements of this chapter; and it shall thereupon become the joint and several duty of such owner, agent, lessee or occupant to proceed forthwith to make whatever changes or alterations may be necessary to make such building comply in all respects with the requirements of this chapter and to complete such changes and alterations within thirty days after the receipt of such notice.

(h) Upon making such annual inspection, it shall be the duty of the owner to pay to the City Collector an annual inspection fee for the same, amounting to three dollars for each 25,000 square feet of floor area, or fractional part thereof: Provided, however, that no charge for such annual inspection shall be made against religious, charitable or educational institutions.

446. **Architect Must Certify That Plans Comply With the Building Ordinances.)** It shall be unlawful for any architect, or other person permitted under the laws of the state to make plans, to prepare or submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with the structural requirements of this chapter. It shall be the duty of the Commissioner of Buildings to require that all plans submitted to him for approval for any building or structure shall be accompanied by a certificate of such architect or such other person preparing such plans that the plans submitted comply with the structural requirements of this chapter.

447. **Constructing Buildings Contrary to Approved Plans—Permit Made Void by Deviation from Plans—Power to Stop Work.)** (a) It shall be unlawful for any owner, agent or architect, or for any contractor or builder engaged in erecting, altering or repairing any building, to make any departure from the plans as approved by the Commissioner of Buildings of such nature that such departure involves any violation of the requirements of this chapter as to buildings of the class in which such building belongs, or to make any changes in plans or construction affecting means of egress, ventilation, natural lighting, or sanitary conditions without first obtaining the written consent of the Commissioner of Buildings and of the Commissioner of Health to such changes. Any such departure from the approved plans involving a violation of the requirements of this chapter or any such change in the plans or construction without the consent of the Commissioner of Buildings and the Commissioner of Health being obtained, as required herein, shall operate to annul the permit which has been issued for such work and shall render the same void.

(b) In case any work is done under a permit authorizing the erection, alteration or repair of a building or structure, which work is contrary to the approved plans, the Commissioner of Buildings or the Commissioner of Health and their assistants shall have power to at once stop such work and to order all persons engaged therein to stop and desist therefrom. Such work shall not be resumed until satisfactory assurance has been given to the Commissioner of Buildings or the Commissioner of Health, as the case may be, that it will be done according to the approved plan or until said Commissioner of Buildings or Commissioner of Health has consented in writing to the changes made in such approved plans, and if such changes in the approved plan involve additional work a new permit or an extended permit shall be issued for which an additional fee shall be paid by the contractor doing such work.

(c) No contractor or builder shall begin any work on any building or structure for which a permit is required until such permit shall have been secured. In case any

work is begun on the erection, alteration, repair or removal of any building or structure without a permit authorizing the same being issued therefor, the Commissioner of Buildings and his assistants shall have power to at once stop such work and to order any and all persons engaged therein to stop and desist therefrom until the proper permit is secured.

ARTICLE III.

Classification of Buildings.

448. **Buildings—Classification of.)** (a) All buildings other than sheds and shelter sheds as hereinafter described, now existing or hereafter erected, altered or enlarged, shall be classified as follows:

(b) **Class I.)** In Class I shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores as described in this chapter. Also such buildings, structures or places with a ground area of five hundred square feet or more used as and for the purposes of a barn, stable or a garage or for the housing or keeping of automobiles.

(c) **Class II.)** In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(d) In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

(e) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(f) In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

(g) **Class III.)** In Class III shall be included every building used as a private residence, also every building used for a hospital where sleeping accommodations for ten or less persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for not to exceed twenty persons or where not to exceed ten bedridden or decrepit persons are housed, and also every building, structure or place with a ground area of less than five hundred square feet used as and for the purposes of a barn, stable or garage or for the housing or keeping of automobiles.

(h) **Class IV.)** In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc, and Class IVd, as follows:

(i) In Class IVa shall be included every building used as a church or place of worship.

(j) In Class IVb shall be included every building having a parish hall, Lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(k) In Class IVc shall be included every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are giver and where the seating capacity does nc exceed three hundred persons, provided, tha every building of Class IVc existing at th time of the passage of this ordinance sha comply with the provisions of Class **IVb.**

(l) In Class IVd shall be included ever grand stand and every baseball athletic an amusement park.

(m) **Class V.)** In Class V shall be ir cluded every building which is used as public theatre where an admission fee i charged and in which movable scenery i used, and every assembly hall hereafte erected having a seating capacity of over 3(persons and containing a permanent stage c which scenery and theatrical apparatus ai used and regular theatrical vaudeville pe: formances are given; provided, however, the public halls and club halls with a seatin capacity of less than 600 persons althoug occasionally used for theatrical presentation shall not be construed to be public theatre within the meaning of the term as used i this section, notwithstanding the fact th: movable scenery is used upon the stage thereof on such occasions, and such publ halls and club halls shall not be considere as buildings of Class V as herein define Such public halls and club halls shall l included in Class IVb, as defined in th section.

(n) **Class VI.)** In Class VI shall be i: cluded every tenement and apartment hou: or building or portion thereof which is use or intended to be used as a home or res dence for two or more families living : separate apartments.

(o) **Class VII.)** In Class VII shall l included every building used for the sale : retail of dry goods and other articles (general merchandise and commonly know and described as a department store.

(p) **Class VIII.)** In Class VIII shall l included every building used for school pu poses and every building containing cla: rooms for special or general instructio other than halls for the purpose of instru tion as included in Class IV, where suc building so used shall have a seating c: pacity of more than fifty students.

(q) **Class IX.)** In Class IX shall be i cluded every building maintained by the Ci of Chicago for police station purposes.

(r) Requirements with regard to buil ings not within any of the above class shall be determined by the Commissioner Buildings subject to arbitration in the sar manner as provided in Sections 407 and 4 of this chapter.

449. **Buildings Used for the Purposes More Than One Class.)** Where any buil ing is used for the purposes of two or mo classes, as herein specified, and defined, su portion of any such building as is devot to the uses and purposes of any particul class shall be constructed, operated ai maintained in accordance with the requir ments of this chapter relating to such clas unless such construction shall, in the opi ion of the Commissioner of Buildings, pro impracticable, or unless there would be conflict between the provisions of this cha ter relating to the construction of building in either of which cases the construction r quirements which relate to and govern t construction of buildings of the class requ: ing the best and safest form of constructi shall govern the entire building.

450. **Conflict Between Special and Gene al Provisions.)** Whenever any provision requirement of this chapter relating specifi ally to the construction, equipment, mai tenance, or operation of any building part of a building used for the purpose any specified class, shall conflict with t general provisions of this chapter relati to the construction, equipment, maintenan and operation of buildings generally, t

special provisions shall govern in each case, except in the case of Section 705, which shall govern in all cases coming within its provisions.

ARTICLE IV.

Buildings of Class I.

451. **Class I Defined.)** In Class I shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores as described in this chapter. Also such buildings, structures or places with a ground area of five hundred square feet or more used as and for the purpose of a barn, stable or a garage or for the housing or keeping of automobiles.

452. **Must Comply With General and Special Provisions.)** Every building of Class I shall comply with the general provisions applicable to the kind of building it is as set forth in this chapter and shall, in addition, comply with the following special provisions.

453. **Buildings—Construction of—in Relation to Height.)** (a) The construction of buildings of Class I shall be as follows: Buildings of Class I which are 100 feet in height or higher shall be built of fireproof construction.

(b) Buildings of Class I which are less than 100 feet in height and more than 50 feet in height shall be built of slow-burning, mill or fireproof construction. Buildings of Class I of slow-burning or mill construction shall not be built more than seven stories in height.

(c) Buildings of Class I of ordinary construction shall not be built more than four stories in height.

454. **Skeleton Steel Walls—Metal Lath and Solid Cement Plaster Covers.)** (a) A one or two story building used for the purposes of Class I, no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting steel frame consisting of wall columns, supporting steel trusses, with steel trusses and steel diagonals, designed to resist safely, within the safe limits of stress provided by this chapter, a wind pressure of twenty pounds per square foot, for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure, and in addition to the live load of 100 pounds per square foot provided for by this chapter, and any other live loads which may be imposed on such structure, may have exterior walls measuring not less than one and one-third inches thick of metal lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. Complete reinforced concrete framework, built in every manner equally as strong and as safe as provided for a steel frame, in this section, may have exterior walls built in the same manner of the same materials and of the same thickness.

(b) The enclosing walls of buildings which are built not less than fifty feet from any lot, alley or street line may be constructed of corrugated iron, supported on a steel frame built as specified in this section.

455. **Buildings for Explosives.)** (a) Buildings for the storage of fireworks and of similar substances or articles of an explosive nature shall have walls of masonry construction, shall not exceed one story in height, shall not exceed sixteen hundred (1,600) square feet in area unless such building is divided into areas of sixteen hundred (1,600) square feet or less by dividing walls the construction of which and the equipment of openings in same being in compliance with the requirements of Section 463 of this chapter. The roof of such building may be constructed of wood joists and roof boards covered with incombustible material or of wood joists covered with sheet metal or of common glass set in metal frames, but in every case at least thirty (30%) per cent of the area of such roof shall be constructed of common glass and metal frames. Such buildings shall be situated not less than one hundred feet from any other building or structure and shall be situated not less than one hundred feet from any lot line, or where such lot line abuts a street, alley or public thoroughfare said building shall be situated not less than one hundred feet away from the opposite side of such street, alley or public thoroughfare.

(b) Buildings erected for the collection or compression of acetylene gas at a pressure of exceeding fifteen (15) pounds to the square inch shall be of fireproof construction throughout and shall be located at least two hundred and fifty feet away from any other building or structure and at least two hundred and fifty feet from any lot line and any street, alley or public thoroughfare.

456. **Buildings for Housing Motor Driven Vehicles.)** (a) Every building or structure hereafter erected and every existing building or structure hereafter increased in size or otherwise altered or hereafter converted or used for the purpose of housing five or more self-propelled vehicles or other wheeled machines, containing in the tanks thereof volatile inflammable liquid for fuel or power, and all adjoining buildings and structures not separated therefrom by dividing walls of brick or concrete extending at least three feet above the roof and having openings, if any, protected on both sides by approved automatic fire doors, where such building or structure is more than one story and less than four stories in height shall be of fireproof construction throughout, or shall be equipped throughout with an automatic sprinkler system. Where any such building is two stories or less in height and complies in all other respects with the requirements for fireproof construction and the second floor area is co-extensive with the area of the building and without openings other than for stairs and elevators, such one or two-story building as aforesaid may have a roof of ordinary, slow-burning or mill construction. Where any such building two stories or less in height has a mezzanine floor or floors with a total area larger than twenty per cent of the area of the building it shall be considered an additional floor and that part or those parts of building containing such additional floor or floors shall be separated from every other part of said building by a wall of brick or concrete built of thickness as required for enclosing walls by the provisions of this chapter, and such parts of building so separated by such dividing wall shall have no openings in their floors from story to story other than is required for stairs and elevators. The openings connecting the different areas of such buildings shall be protected by double automatic fire door equipment. Every such building or structure more than three stories in height shall be of fireproof construction throughout and shall be equipped throughout with an automatic sprinkler system. In all such buildings more than two stories in height all window openings, except in walls that adjoin a public street fifty feet or more in width, shall be equipped with approved metal frames and sash glazed with wired glass. Buildings less than three stories high shall comply with the requirements of Section 784 of this chapter. All floor openings in non-fireproof buildings shall be enclosed in walls of masonry of such thickness as required by the provisions of this chapter and shall extend from the ground through the roof of the building; in fireproof buildings, all elevator shafts and other vertical shafts except stairways shall be enclosed in every story with walls of brick, tile, plain or reinforced concrete at least eight inches thick, all stairways shall be

enclosed in every story with walls of brick, tile or reinforced concrete at least four inches thick and all openings in such enclosing walls shall be equipped with approved automatic or self-closing fire doors. There shall be no basement in any such building, except for boiler room purposes, unless such building, including the roof and the protection of the roof beams and roof girders, is of fireproof construction throughout and is equipped throughout with an automatic sprinkler system, and with no floor openings between the basement and other floors, except for stairs and elevators, and such openings shall be enclosed in both the basement and first floor by walls of brick or concrete at least eight inches thick or of fireproof tile at least twelve inches thick and equipped with doors as hereinbefore specified. There shall be no openings from the boiler room except to the outside of the building. Where such building is on a lot that adjoins two streets or a street and an alley whose established grades are not at the same elevation the story whose floor is higher than two feet below the lower of these grades shall, for the purpose of this section, be deemed the first story of said building.

(b) Every building, structure or place not now used for the housing of four or less vehicles containing volatile inflammable liquid in the tanks thereof but hereafter converted to such use, and every building or structure hereafter erected for the housing of four or less such vehicles, where so used, must be occupied and used exclusively for such purposes under the following conditions and with the exceptions hereinafter noted:

Frame sheds or buildings may be so used if such shed stands at least five feet from every other building or structure on the same lot or plot of ground; provided, however, that in frame buildings used exclusively for Class I purposes a portion of such building may be so used if the part so occupied is separated from all other parts of the building by a brick dividing wall extending three feet above the highest point of the roof, and in said dividing wall all openings, if there are any, shall be equipped with standard automatic or self-closing fire doors on each side of the wall.

Brick buildings with roof of ordinary construction may be so used if they are located three feet or more from every other building or structure upon the same lot or plot of ground. In buildings of ordinary, slow-burning or mill construction used exclusively for Class I purposes, four or less such vehicles may be housed provided that part of the building so occupied is separated from all other parts of such building by a brick wall extending three feet above the highest point of the roof and in which the openings, if any, are equipped with approved automatic or self-closing fire doors on each side thereof. If such building is more than one story high in lieu of extending hereinbefore required wall through the upper stories and through the roof as described, the floor system immediately above space in which such vehicles are kept may be built of fireproof construction connecting with wall separating such space from other parts of the building and which is carried through the story so occupied by such vehicles.

Brick buildings with a roof of fireproof construction may be so used and may adjoin any other building or structure, but no openings shall connect the same with any building other than a building of Class I.

Buildings containing not to exceed one living apartment and in which four or less vehicles containing volatile inflammable liquid are housed, must have brick or masonry walls and not exceed two stories in height. The floor of the second story shall be of fireproof construction throughout or if of combustible material shall be protected on the underside for the entire area of such floor by two complete coverings of metal lath and fire-resisting plaster applied separately. There shall be two stairways from said apartment to the ground placed as far apart as practicable, one of such stairways may be an outside stairway. The interior stairway or stairways shall be enclosed on the first floor by partitions of four-inch tile or partitions of metal lath and plaster on metal studding in such a manner that exit by means of the stairway shall be direct to the outside of building, and there shall be no doorways or other openings from enclosure containing such stairway into the first story.

457. **Buildings for Smoking Meats.)** Buildings or structures for the purpose of smoking meats or fish shall have brick walls and shall have a roof of fireproof construction. No combustible material shall be used in the erection of such building. Where smoke houses are built inside of another building, they shall be constructed entirely of metal or have brick walls with a fireproof roof or ceiling and no combustible material shall be used in their construction.

458. **Buildings for Dry Cleaning.)** Buildings in which machinery and equipment is installed for the purpose of dry cleaning shall stand at least fifty feet from any lot line and not nearer than fifty feet to the nearest point of approach of any other buildings or structure upon the same lot. Such buildings shall be of fireproof construction, shall not be over two stories in height and shall have no basement or attic. Walls shall be at least twelve inches thick. All window openings in outside walls shall be equipped with approved metal frames, metal sash and wired glass. All exterior and interior door openings shall be equipped with an approved three-ply laminated door covered with sheet metal or its equivalent in fire-resisting quality. There shall be no floor openings except for one interior stairway and said stairway shall be enclosed upon the first floor in such a manner as to give direct exit from stair and stair hall to the outside without any doorway or other opening from stair or stair hall to first story of building. An additional outside metallic stairway or additional stairways at least three feet wide shall also be provided. The boiler shall be located in a separate building and so situated that the line of travel for gases between any opening in boiler room and the opening in the dry cleaning or dry room shall be not less than twenty feet. Such dry cleaning and dry room shall be provided with vent holes at the floor line not less than sixteen square inches in area, at least six feet apart.

459. **Buildings for Motion Picture Films.)** Buildings for the storage of more than two thousand (2000) feet of motion picture films, or buildings in which more than two thousand (2000) feet of motion picture films are stored shall be of ordinary, slow-burning, mill or fireproof construction and not more than two stories high, unless of fireproof construction. In all buildings in which motion picture films are stored all elevators and stairs shall be enclosed in all stories where such film storage occurs, and in all stories above such stories where motion picture films are stored. In buildings of ordinary construction such stair and elevator enclosure shall be of brick walls at least twelve (12) inches thick supported on the ground or upon fire-proofed structural steel. In fireproof buildings all elevators and stairs shall be enclosed with brick walls at least eight (8) inches thick, or with reinforced concrete or with fireproof tile at least four (4) inches thick.

Vaults for the storage of motion picture films in non-fireproof buildings shall be of

brick or of reinforced concrete at least twelve (12) inches thick. The floors and tops of such vaults shall be of brick or of concrete or of reinforced hollow tile at least twelve (12) inches thick, or of reinforced concrete at least eight (8) inches thick. In fireproof buildings vault walls shall be of either fireproof tile, brick, concrete or reinforced concrete. The floors and tops shall be of brick or of concrete at least twelve (12) inches thick, or of reinforced concrete at least eight (8) inches thick, or of fireproof tile or of reinforced hollow tile at least ten (10) inches thick. The thickness of vault walls shall be the same as herein specified for floors and tops where the same material is used for their construction, except that walls of fireproof tile shall be at least twelve (12) inches thick.

The vent flues for vaults shall be of the same construction as is required for smoke flues of the same area for such buildings. In fireproof buildings such vent flues may have walls at least four (4) inches thick of stone or gravel concrete reinforced with three-eighths (⅜) inch diameter round steel rods. Rods shall be set both vertically and horizontally, shall be spaced twelve (12) inches on centers where set horizontally and shall be spaced eighteen (18) inches on centers where set vertically. Or the walls may be four (4) inches thick of hollow clay tile set with the voids vertical and having all voids filled with stone or gravel concrete and with all joints filled with cement mortar and have metal bands at least one-fourth (¼) inch thick by one (1) inch wide embedded within the horizontal joints on all sides of the flue at intervals of not less than four (4) feet in height such bands being secured to metal plates four (4) inches square and one-fourth (¼) inch thick placed flat against the outside face of the tile, or bands shall be secured to each other in a manner to effectually prevent walls of the flue from spreading when subjected to heat. Where two or more flues are built together the bands may extend from outside to outside of the group or be arranged in such a manner as to effectually prevent the spreading of the walls of any flue within the group. Where tile is used for flues the exterior walls of detached flues or the outside walls of a group of flues shall be covered with two coats of cement plaster on wire lath brought close to the intersecting walls, floors and ceiling. Above the roof level tile walls shall be encased with four (4) inches of brick laid in cement mortar. Vent flues for vaults which are located in the top story of a fireproof building may be constructed of No. 14 U. S. gauge metal from the vault connection to the termination of the flue, and all that portion of the flue which is within the building and all that is not more than eighteen (18) inches above the roof shall have a coating of asbestos plaster at least two (2) inches thick covered with two coats of cement plaster on metal lath. Such other construction of vent flues will be permitted as will meet with the approval of a Board consisting of the Commissioner of Buildings and the Chief of Fire Prevention and Public Safety and shall be regarded by such board as being equal in character and fire-resisting qualities to the foregoing.

In buildings of fireproof construction rooms for examining and for repairing motion picture films shall be enclosed in partitions of fireproof or incombustible material at least four (4) inches thick.

In buildings of fireproof construction rooms used for receiving, distributing or the shipping of motion picture films shall be enclosed in partitions or walls of brick or concrete or fireproof tile at least eight (8) inches thick, or of reinforced concrete at least six (6) inches thick.

Such partitions and the enclosing walls of such rooms, except where they face upon a public street at least fifty (50) feet wide, shall have window openings in same equipped with approved metal frames and sash and glazed with wired glass, and all door openings shall be equipped with approved single automatic-closing fire doors.

In non-fireproof buildings in addition to all of the above requirements, the floors and ceilings of such rooms or compartments must be of fireproof construction as defined in this chapter.

460. **Door Openings—Revolving Doors.)** (a) The aggregate width of door openings at or approximately at the street level in buildings of Class I shall be equal to the aggregate width of stairways, as specified in Section 878 of this chapter for buildings of Class I. Where locks are used on exit doors or on doors or gates leading to hallways or stairways which lead to exit doors they shall be so arranged that the door or gate may be opened from the inside without the use of a key. Where locks are used on automatic fire doors in stair shafts of buildings in which approved sprinkler systems are installed, said doors may contain just above the locking device a fire-resisting glass panel containing not less than 81 square inches nor more than 450 square inches of exposed fire-resisting glass. In every building of this class every door to an exit which is a means of egress for twenty or more persons shall open outward, and every door which is a means of exit from any floor above the first, shall open outwardly from the space or hallway in which the stairway from such upper floor is located. A door or doors when open shall not project over a public sidewalk or public space.

(b) Revolving doors shall not be installed in any door opening of any building unless the revolving wings of such revolving doors are so arranged that, by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said door fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed and all deficiency of required exits must be made up by additional doors.

461. **Existing Buildings of Class I — Increasing Height of.)** In all cases where buildings of Class I of ordinary construction built prior to March 13, 1911, are to be increased in height above the height of fifty feet, or of mill or slow-burning construction above the height of ninety feet, the additional parts of such buildings shall be constructed as herein provided for buildings over fifty feet in height or over ninety feet in height, respectively, and said additional parts shall be made to conform in all respects to the requirements for buildings of this class more than fifty feet in height or more than ninety feet in height, respectively, before it shall be lawful to occupy them.

462. **Fire Walls.)** (a) Buildings occupied by more than one person, firm or corporation, or for more than one business enterprise conducted by the same person, firm or corporation, in separate enclosures on any one floor, shall have a brick dividing wall for every fifty feet of street frontage, if of ordinary construction, or for every eighty feet of street frontage, if of slow-burning

or mill construction, and such dividing walls shall extend from the front to the rear wall and such dividing walls and the doors therein shall be built in accordance with the provisions of Section 789 of this chapter.

(b) All of the partitions between the parts of such buildings occupied by different persons, firms or corporations, shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

(c) Only metal framed windows glazed with one-quarter inch thick wire glass may be used in such partitions.

463. **Dividing Walls—When Required.)** (a) Dividing walls will be required in buildings of Class I as follows:

(b) Every building of ordinary construction having a greater area than 9,000 square feet shall be divided into areas of 9,000 square feet or less by dividing walls; provided, however, that buildings of ordinary construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of ordinary construction with areas not greater than 9,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stair halls at street or ground level so constructed as to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief of Fire Prevention and Public Safety may be built with an area of 12,000 square feet but if of greater area shall be divided into areas of 12,000 square feet or less by dividing walls.

(c) Every building of slow-burning or mill construction more than one story in height having greater area than 12,000 square feet, shall be divided into areas of 12,000 square feet or less by dividing walls; provided, however, that buildings of slow-burning or mill construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of slow-burning and mill construction having areas not greater than 12,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stairhalls at street or ground level so constructed as to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief of Fire Prevention and Public Safety, may be built of an area of 16,000 square feet, if of greater area shall be divided into areas of 16,000 square feet or less by dividing walls.

(d) Every fireproof building more than two stories in height and having greater area than 30,000 square feet, shall be divided into areas of 30,000 square feet or less by dividing walls.

(e) Where dividing walls are required in any of the above mentioned buildings, such building shall be subdivided by brick walls, built of the thickness given in the table for the thickness of enclosing walls and all doors or other openings in such walls shall have at each side of the same, iron doors, tin clad doors or shutters, as described in Section 789 of this chapter, and said buildings as subdivided shall be provided with stairs and fire escapes the same as hereinafter required; provided, however, that one-story buildings of ordinary mill or slow-burning construction and two-story buildings of fireproof construction of any size when used as one store, room or workshop and occupied by only one person, firm or corporation, may be erected without any dividing walls.

464. **Display of Placard—Indicating Floor Strength—Fee.) (a)** It shall be the duty of the owner of every building of Class I now in existence or hereafter erected, or of his agent, or of the occupant, or person in possession, charge or control of same, to affix and display conspicuously on each floor of such building, a placard, stating the uniformly distributed load per square foot of floor surface, which may with safety be applied to that particular floor, as provided by this chapter, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors or any part thereof to a greater extent than the loads indicated upon such placards.

(b) It shall be the duty of the occupants of such buildings to maintain such placards during their occupation of the premises and it shall be the duty of the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be the duty of the owner, agent or lessee of each such building, now in existence, or hereafter erected, to procure and submit evidence of the correctness of the figures on such placards to the Commissioner of Buildings. Whenever such evidence as to the correctness of the figures shall be satisfactory to the Commissioner of Buildings, he shall approve such placards. Such placards so approved by the Commissioner of Buildings shall then be affixed upon the respective floors of the different buildings. The calculations and loads shall be in accordance with the provisions of this chapter.

(c) It shall be the duty of the owner, agent or lessee to pay to the City Collector a fee amounting to five dollars for each ten thousand square feet of floor area or less, for more than ten thousand square feet of floor area and not to exceed fifty thousand square feet of floor area ten dollars, for each additional fifty thousand square feet of floor area in excess of the first fifty thousand square feet of floor area ten dollars additional, and for issuing new placards in place of lost placards, the fee shall be for ten thousand square feet or less two dollars; for more than ten thousand square feet, five dollars. For the purpose of determining the amount of the fee herein required to be paid, every part of a structure separated by dividing walls as required by Section 463 of this chapter shall be considered as a separate building.

465. **Live Loads for Floors.)** The floors of all buildings of Class I hereafter erected shall be designed and constructed in such a manner as to be capable of bearing, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and the strength of such building shall be increased above the capacity to carry such a live load of one hundred pounds per square foot of floor surface, when the uses to which such building, or part thereof, is to be applied, involve greater stress. The calculations and loads shall be in accordance with the provisions of this chapter. In every building of Class I now constructed and in use, whenever it shall be found by the Commissioner of Buildings that the floors of same, or any part or parts thereof, are not capable of bearing, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be upon the same, a live load of forty pounds for every square foot of surface, he shall condemn the same and

order such floor or floors to be repaired or reconstructed within a reasonable time by the owner or occupant thereof, and shall proceed in the manner prescribed in sections 402 and 403 of this chapter, and in such case it shall be unlawful for the owner or occupant to continue to use such building until the said floors shall be repaired or reconstructed in accordance herewith.

466. **Elevator Buildings.)** Elevator buildings intended solely for the receipt, storage and delivery of grain in bulk, shall be of fireproof construction as described in this chapter.

ARTICLE V.

Class II.

467. **Class II Defined.)** (a) In Class II shall be included every building referred to in subdivisions herein designated as Class IIa, Class IIb and Class IIc.

(b) In Class IIa shall be included every building used for office purposes, and also every building used for clubhouse purposes where sleeping accommodations are provided for less than twenty persons.

(c) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(d) In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

468. **Must Comply with General and Special Provisions.)** Every building of Class II shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

469. **Load Bearing Capacity of Floors in Buildings of Class II.)** For all buildings of Class II the floors shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of fifty pounds per square foot of surface, and such floor bearing capacity shall be computed in accordance with the provisions of this chapter.

470. **Windows and Mechanical Ventilation.)** (a) In every building hereafter erected for or converted to the purposes of this class, courts shall be of the minimum widths and areas prescribed in Section 644 of this chapter, and vent shafts as defined in Section 634 of this chapter, shall be of the following minimum width and areas:

Height of Shaft.	Least Width in Feet.	Square Feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 or more stories	8	120

(b) In every building hereafter erected for or converted to the purposes of this class, every room used as a private sitting room or as a sleeping room, shall have at least one window which opens directly upon a street, alley, yard or court. The total glass area of such window or windows opening directly upon a street, alley, yard or court shall be not less than one-tenth of the floor area of such room. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened. No such window shall have a glass area of less than ten square feet unless it be a window in excess of the one-tenth of the floor area as required by this paragraph. Provided that sleeping cells in prisons, jails, police stations and houses of detention need not have each a window opening directly on a street, alley, yard or court if such cells are in a cell block which has windows with a glass area equal to one-fourth of the floor area of such block and arranged so that each window may be opened for one-half of its area, and provided further that such cell block and cells shall be equipped with a system of mechanical ventilation approved by the Commissioner of Health.

(c) In every building hereafter erected for or converted to the purposes of this class, every pantry, bath room and water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such window or windows opening directly upon a street, alley, yard, court or vent shaft shall be not less than one-tenth of the floor area of such room or compartment. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened; and no such window shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located in the upper story of any such building, may be lighted and ventilated by means of a skylight having a glass area equal to one-tenth of the floor area of the room it serves and be equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth of the floor area of such room; and provided further, that any such room or compartment in a building used for office, club, hospital or hotel purposes, in lieu of such window or windows, may be ventilated by an approved mechanical ventilation system which shall effect at least six complete changes of air per hour.

(d) In every building hereafter erected for or converted to office, hotel or club purposes, every room, except a room used as a bakery, which is below street grade and which is frequented by the public or in which there are regularly employed five or more persons, shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour; provided that in case of store rooms below street grade having 1,500 cubic feet of space per person employed therein two changes of air per hour will be deemed sufficient. In buildings of this class every room, either above or below grade, used as a bakery, shall comply with the provisions of the ordinances of the City of Chicago in respect to bakeries.

(e) In every building hereafter erected for or converted to the purposes of this class, every room not otherwise specifically provided for in this section shall, where practicable, have a window or windows, with a total glass area not less than one-tenth of the floor area of such room, opening directly onto a street, alley, yard or court, and no such window shall have a width of less than one foot or a total glass area of less than ten square feet, unless such window is in excess of the ten per cent of floor area requirement; provided that, if it be impracticable to ventilate any such room by windows as aforesaid, such rooms shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour;

the air supply being taken from the outer air at a point not less than ten feet above the street level.

(f) It shall be the duty of the owner, agent, architect, or party in possession or control of any building in which a mechanical system of ventilation shall have been installed under the requirements of this section, upon completion of such system, to notify the Commissioner of Health in writing at least twenty-four hours in advance of the making of a test of such system; and each such system or unit shall be tested for volumetric efficiency by the owner or his representative in the presence of the representative of the Commissioner of Health and such system shall not be considered as meeting the requirements of this section until it shall have been approved by the Commissioner of Health. Every such mechanical ventilating system shall at all times be kept in good repair and in operation so as

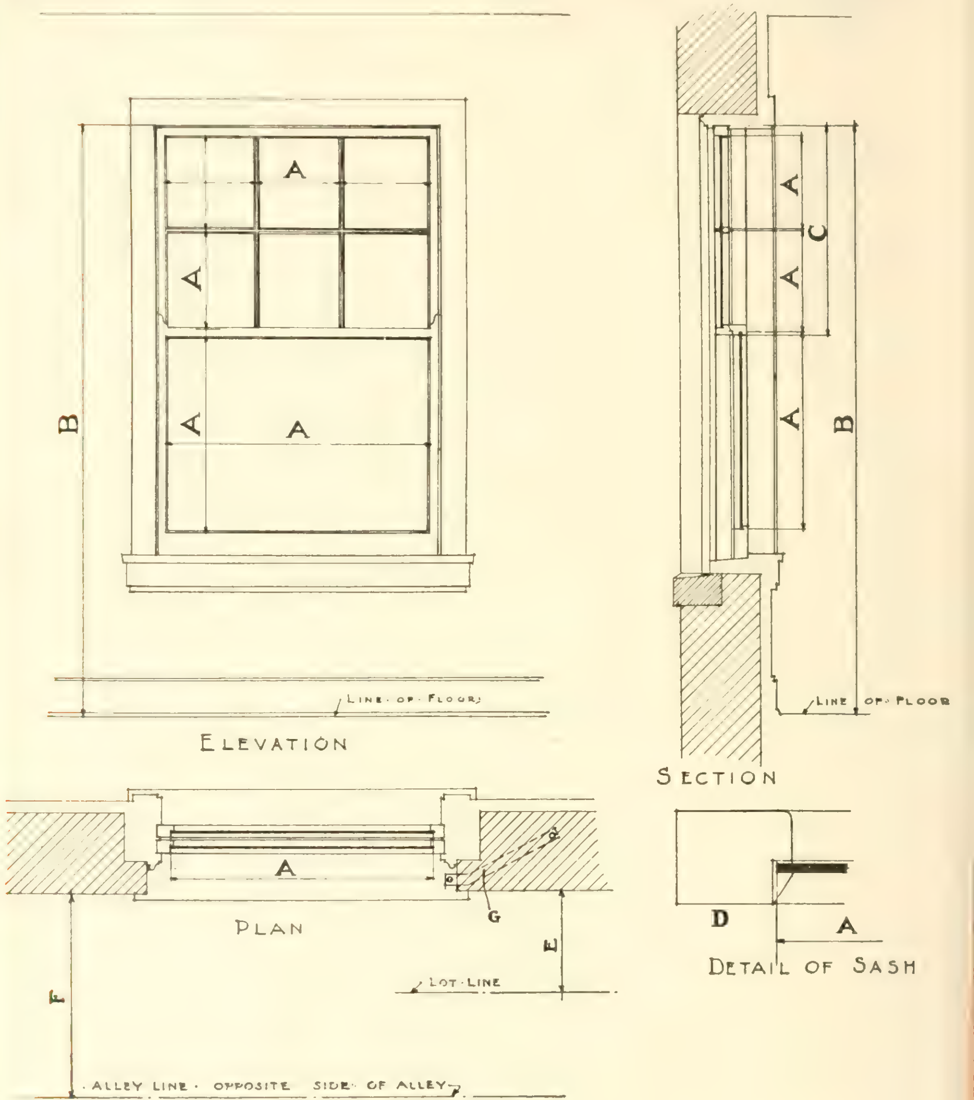

Fig. 2.

WINDOWS.

Sections 470b, 476, 488, 650, 677, 678, 784, 788.

(A) Where measurement of glass is taken.
(B) Top of window.
(C) One-half of window.
(D) Detail of sash showing where (A) is taken, under ordinary conditions.

Area of glass would be (A x A).

Total area would be summation of all (A x A).

Windows to be constructed so that upper half (C) can be opened.

(E) If E is less than 15 ft. wide, metal frames and wire glass to be used; and the glazed portion of frames to be set with fire resisting glass, as provided in ordinance. (Sec. 784).

(F) If F is less than 30 ft., metal frames and wire glass to be used; and the glazed portion of frames to be set with fire resisting glass, as provided in ordinance. (Sec. 784).

For exceptions where steel rolling shutters. etc., are used see ordinance. (Sec. 784a).

(G) Provision made for safety device in cleaning of windows. (Sec. 788).

to insure the required ventilation of all rooms and compartments planned to be ventilated thereby, during all hours of human occupancy.

Class IIa.

471. **Class IIa Defined.)** In Class IIa shall be included every building used for office purposes. and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

472. **Buildings—Construction of—Height of.)** (a) Buildings of Class IIa which are ninety feet or more in height shall be built entirely of fireproof construction.
(b) Buildings of Class IIa less than ninety feet and more than fifty feet in height shall be built either of slow-burning, mill or fireproof construction.
(c) Buildings of Class IIa not exceeding fifty feet in height may be built of ordinary construction.

Class IIb.

473. **Class IIb Defined.)** In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

474. **Buildings—Construction of—Height of.)** (a) Buildings of Class IIb more than five stories and basement high shall be of fireproof construction.

(b) Buildings of Class IIb more than three stories and basement high but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

475. **Walls—Divisions and Partitions—Fire Stops.)** (a) In buildings hereafter erected used wholly, or in part for the purposes of Class IIb of ordinary, slow-burning or mill construction, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material separating such eight rooms from the contiguous spaces.

(b) In all buildings hereafter erected to be used wholly or in part for the purposes of Class IIb, all elevators and stairs shall be enclosed in partitions of incombustible or fireproof material, and the partitions of all corridors leading to such elevators and stairs shall be of fireproof or incombustible material. Such partitions shall be carried on self-supporting masonry or a framework of steel or iron. Where glass is used in said partitions, the same shall be wired glass set in metal frames but such glass shall not exceed sixty per centum of the superficial area of said partitions.

(c) In all non-fireproof buildings of Class IIb there shall be between joists a stop of brick, concrete or tile not less than four inches in thickness, extending the full height of joists and spaced not more than twenty-five feet apart, measured in the direction of the length of the joist.

476. **Sleeping Stalls in Rooms—When Allowed.)** Sleeping stalls shall not be constructed or used in any room in any building now existing or hereafter erected and devoted, in whole or in part, to the purposes of a lodging or rooming house unless such room has two or more windows which open directly upon a street, alley, yard or court and which windows have a total area equal to at least one-tenth of the floor area of such room, nor unless the semi-partitions forming such stalls are so constructed that there is a clear and unobstructed interval of at least thirty inches between the top of such semi-partitions and the ceiling of the room, nor unless each such stall shall open directly into an aisle or passageway leading directly to a stairway or stairway fire escape, the location of which is indicated by a red sign and at night by a red light also. Such sleeping stalls shall not be installed in any such room in such numbers that there shall be less than 400 cubic feet of air per person when all stalls are occupied to their full capacity. The semi-partitions forming such stalls hereafter constructed shall be of incombustible material.

(See Illustration Sec. 470b.

Class IIc.

477. **Class IIc Defined.)** In Class IIc shall be included every building used for a hospital where sleeping accommodations for more than ten persons are provided in such building and every building used for a home, day nursery or asylum where any such building shall have accommodations for more than twenty persons or where more than ten bedridden or decrepit persons are housed, and every building used for a jail, house of correction or detention.

478. **Buildings—Construction of—Height of.)** (a) All buildings of Class IIc not more than two stories and basement in height may be of ordinary mill or slow-burning construction.

(b) All buildings of Class IIc more than two stories and basement in height shall be of fire-proof construction.

479. **Frontage Consents for Hospitals.)** It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any hospital in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted to exclusive residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building fronts and faces consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in said block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license be issued for the maintaining, conducting or managing of any such hospital.

480. **Coves in Rooms and Corridors of Hospitals.)** In every building hereafter constructed for or converted to hospital purposes, in all corridors and rooms used by patients, all intersections of walls, floors and ceilings shall be formed with tangent coves.

481. **Elevators in Hospitals.)** Every building over three stories in height hereafter constructed for or converted to hospital purposes shall have at least one elevator, the floor dimensions of which shall be not less than seven feet by five feet, and said elevator shall be enclosed in a fireproof shaft with incombustible doors closing off each opening and shall comply with all the general provisions of this chapter.

482. **Fire Escapes, Balconies, Platforms.)** All buildings of Class IIc shall be equipped with stairway fire escapes not less than three feet in width which shall, in number, location and structural features, comply with the general provisions of this chapter relating to fire escapes. The balconies and platforms of such fire escapes shall be not less than three feet in width and may be made with a smooth surface of incombustible material laid flush with the floor and with a pitch of one-third inch to the foot.

ARTICLE VI.

Class III.

483. **Class III Defined.)** In Class III shall be included every building used as a private residence, also every building used for a hospital where sleeping accommodations for ten or less persons are provided in such building, and every building used for a home, day nursery or asylum where any such building shall have accommodations for twenty or less persons or where not more than ten bedridden or decrepit persons are housed, and also every building, structure or place with a ground area of less than five hundred square feet used as and for the purposes of a barn, stable or garage or for the housing or keeping of automobiles.

484. **Must Comply With General and Special Provisions.)** Every building of Class III shall comply with the provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

485. **Buildings—Construction of—Height of—Space Occupied on Lot.)** (a) Every building of Class III which is ninety feet or more in height shall be built entirely of fireproof construction.

(b) Every building of Class III less than ninety feet and more than fifty feet in height shall be built entirely of slow-burning mill or fireproof construction .

(c) Every building of Class III less than fifty feet in height may be built of ordinary construction.

(d) The amount of space occupied on any lot by Class III buildings shall comply with the requirements of Section 642 of this chapter.

(e) Buildings used for garage purposes only, having a ground area of four hundred (400) square feet or less, may be built with enclosing walls and roof of corrugated iron or galvanized sheet steel supported on a frame of steel construction.

486. **Skylights—Construction of — Glass in.)** (a) The skylight on the roof of every building of Class III erected within the fire limits shall have its sides, sashes and frames constructed of metal or of metal-clad wood on all exterior surfaces.

(b) Such skylights shall be covered by a strong wire netting with mesh not more than one and one-half inches square placed not less than six inches above the glass, supported on uprights of incombustible material, unless wired glass is used.

487. **Allowances of Live Loads in Construction of Floors.)** In every building of Class III, the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of 40 pounds for every square foot of surface.

488. **Habitable Rooms—Definition of—Requirements as to Size and Ventilation.)** (a) For the purposes of this chapter the term "habitable room" shall be held to include every room in every building of Classes III and VI, and every room in buildings of other classes if such rooms are used for the purposes of Classes III and VI, in which a family or the individual members thereof regularly sleep or eat or carry on their usual domestic or social vocations or avocations. Laundries, bath rooms, water closet compartments, serving and storage pantries, storage rooms and closets, boiler and machinery rooms, cellars, corridors, and similar spaces used neither frequently nor during extended periods, shall not be deemed as coming within the scope of this term.

(b) In every building hereafter erected for or converted to the purposes of Class III, every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area, opening onto a street, alley, or yard, as defined in Section 634 of this chapter. None of such required windows shall have a glass area of less than ten square feet; and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width. No such habitable room shall have a floor area of less than eighty square feet, nor a clear height from floor to ceiling of less than eight feet and six inches; provided that attic rooms need not be eight feet six inches high for more than one-half of their area, and provided further that such attic rooms shall have total cubic contents of not less than seven hundred and fifty cubic feet each.

(c) No living room shall be partitioned off or constructed in any existing building or portion thereof, until plans of such building and room have been filed with, and a permit for such partitioning or constructing obtained from the Commissioner of Buildings and the Commissioner of Health; and every room so partitioned off or constructed shall comply with all the requirements for habitable rooms as contained in this section.

(See Illustration Sec. 470b).

489. **Alcoves.)** Every alcove and alcove room shall comply with the requirements of Section 648 of this chapter.

490. **Pantries, Bath Rooms, Water Closet and Urinal Compartments—Requirements in Relation Thereto.)** In every building hereafter erected for or converted to the purposes of Class III, every pantry, bath room, water closet or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of at least one foot opening upon a street, alley, or yard as defined in Section 634 of this chapter, or upon a vent shaft not less in area than said window; and no habitable room shall open into or connect with a vent shaft thus used.

491. **Bay Windows and Light Shafts—Materials For.)** Bay or oriel windows may be built of combustible material on front or rear elevations of buildings of Class III of two stories or less in height, within the fire limits, provided such bay and oriel windows shall not have a greater width than twelve feet at the wall line of the building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows, when so constructed, shall be covered with sheet metal or other incombustible material. Light shafts wholly within the walls of a two-story building of Class III may be built of combustible material covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

492. **Walls—Brick Walls Upon Wooden Sills—Level of Sills Allowed.)** Every building of Class III not exceeding one story or twenty feet in height from top of sills to the highest point of the roof, and with the side walls not exceeding fourteen feet in height, and with floor area not exceeding twelve hundred square feet, may have brick walls not less than eight inches in thickness erected upon wooden sills, the sills supported on iron, masonry, or concrete supports extending four feet below the surface of the ground, provided that the portion of the supports above the ground may consist of cypress or cedar posts. The foundations under such supports shall be of concrete, stone or brick, each covering not less

than five square feet area and not more than eight feet apart, to support with safety the weight that may rest upon them; sills shall be placed not higher than four feet above the established grade of the street upon which the lot fronts and upon which lot the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. Every building more than one story and less than two stories high, having a gable or hip roof with a rise of not more than thirty degrees, may have eight-inch walls of solid brick or stone masonry, provided the side walls do not exceed fourteen feet in height measured from the first floor joist, and provided such building has a floor area not exceeding 1,200 feet and is not over 22 feet in width.

493. **Stairways in Buildings of Class III Three Stories or More in Height.)** (a) In every building of Class III hereafter erected, and three stories or more in height, there shall be either two stairways from the first to the top story or one such stairway and a stairway fire escape.

(b) In every building of Class III now in existence, and three stories or more in height with a floor area of 1,000 square feet above the second floor, which is not equipped with two stairways or with one stairway and a stairway fire escape, safe and adequate means of egress from all floors shall be provided by the erection of additional stairways or stairway fire escapes, or such other means as in the judgment of the Commissioner of Buildings are required for the safety of the occupants of such building or the public.

(c) In every building of Class III now in existence or hereafter erected used for hospital, home, day nursery or asylum purposes there shall be provided at least two stairways located as far apart as practicable and extending from the top story to the ground. A separate door exit shall be provided for each stairway to the outside of the building.

ARTICLE VII.

Class IV.

494. **Class IV Defined.)** (a) In Class to in subdivisions herein designated as Class IVa, Class IVb, Class IVc and Class IVd, as follows:

(b) In Class IVa shall be included every building used as a church or place of worship.

(c) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(d) Class IVc shall include every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred; provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(e) In Class IVd shall be included every grandstand and every baseball, athletic and amusement park.

495. **Must Comply With General and Special Provisions.)** Every building or structure of Class IV shall comply with the general provisions of this chapter and shall, in addition, comply with the following special provisions:

496. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct or alter any Class IV building except in conformity with the ordinances of the City of Chicago relative thereto, or to operate any Class IV building that does not conform thereto.

497. **City Officials Empowered to Enter.)** The Commissioner of Buildings, Commissioner of Health, Commissioner of Gas and Electricity, Fire Marshal, Chief of Fire Prevention and Public Safety, General Superintendent of Police, and their respective assistants, shall have the right to enter any building used in whole or in part for the purposes of Class IV at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any person to interfere with them in the performance of their duties.

498. **City Officials Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Marshal, Chief of Fire Prevention and Public Safety, Commissioner of Gas and Electricity, General Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV, to be closed, where it is discovered that there is any violation of any of the provisions of this chapter, and kept closed until the same are complied with.

499. **Theaters in Frame Buildings Prohibited.)** No frame building or part thereof shall be used as a moving picture, vaudeville or other theatre.

500. **Buildings — Height — Construction — When Used in Part as Class IV.)** Every building higher than sixty feet, used in whole or in part for the purposes of Class IV or connected with or made part of any building so used, shall be entirely of fireproof construction. Every such building less than sixty feet in height shall be made of fireproof, slow-burning or mill construction, except as provided in this chapter.

CLASS IVa

501. **Class IVa Defined.)** In Class IVa shall be included every building used as a church or place of worship.

502. **Frontage—Seating Less Than Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity of 800 persons or less, shall have for the auditorium a frontage upon two open spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

503. **Frontage—Seating Over Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity greater than eight hundred persons, shall have a frontage upon three open spaces of which at least one shall be a public street and the others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street or alley, with at least one exit into each open space.

504. **Construction of.)** Every building of Class IVa, which has a seating capacity of less than 600 may be built of ordinary construction. Every building Class IVa having a seating capacity of more than 600 and less than 1,800 shall be built of slow-burning mill or fireproof construction.

505. **Fireproof Construction Necessary When.)** Every building of Class IVa having an aggregate seating capacity greater than 1,800 persons shall be built of fireproof construction.

506. **Limitations of Floor Level in Class IVa—Height Above Sidewalk.)** (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVa, shall be as follows:

(b) No auditorium of a greater seating capacity than 1,000, shall have the highest part of its main floor at a greater distance than 10 feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVa having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVa, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVa and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than 4 feet wide in the clear and shall be equipped with emergency exits and not less than one stairway fire escape.

507. **Allowance for Live Loads in Construction of Floors in Buildings of Class IVa—Stairways—Width of Entrances and Exits.)** Every floor in buildings of Class IVa shall be designed and constructed in such a manner as to be capable of bearing in all its parts, in addition to the weight of floor construction, partitions, and permanent fixtures that may be set upon same, a live load of 100 pounds for every square foot of surface on such floor. The width of stairways in buildings of this class shall be twenty inches for every one hundred of the aggregate seating capacity, and for fractional parts of one hundred seating capacity, a proportionate part of twenty inches shall be added to the width of such stairway, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided, and provided that in any such building having a gallery, the seating capacity of which does not exceed two hundred and fifty persons, two separate and distinct stairways, each not less than three feet wide, shall be permitted.

508. **Galleries — Exit and Entrance.)** Distinct and separate exits shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the gallery or galleries, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such gallery or galleries to such place of exit or entrance. Not more than two galleries, placed one above the other, shall be permitted in any building of Class IVa.

509. **Width of Aisles—Steps in Aisles.)** Aisles in buildings of Class IVa shall, in the aggregate, be eighteen inches in width for each 100 of the seating capacity of the auditorium, and for fractional parts of 100 a proportionate part of 18 inches shall be added, but no aisle shall be less than two feet six inches in width in its narrowest part. Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than 5 inches, the floor of the aisles shall be made on an inclined plane; and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

510. **Corridors, Passageways, Hallways and Doors—Width of.)** The width of corridors, passageways, hallways and doors, adjacent to, connected with, or a part of the auditorium, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such doorway shall be less than three feet in width.

511. **Seats, Number of, in Rows.)** There shall not be more than fourteen seats in any one row between aisles. Rows of seats shall not be less than two feet eight inches from back to back, and no bank of seats shall be of greater rise than twenty incnes.

512. **Emergency Exits—All Doors to Open Outward.)** (a) Emergency exits and outside stairways shall be provided for every building of Class IVa, which has a larger seating capacity than 800. Such emergency exits shall be one-half the aggregate width of the main exits, but no such emergency exits shall be less than three feet in width. Provided, that such stairways may be built inside the walls of the building in a corridor or passageway not less than seven feet wide and enclosed by a fireproof partition not less than four inches thick. Such stairway shall be of fireproof construction. All emergency exits and stairways therefrom shall be kept free from obstructions of any kind including snow and ice.

(b) All doors affording egress, directly or indirectly from the auditorium to a street or alley, shall open outward. Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the time that the building is occupied, and shall be so constructed and maintained that they may be easily opened from within.

513. **Buildings in Which Seats are Not Fixed—Seating Capacity.)** In computing the seating capacity of any room or building used for the purposes of this class in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVa standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of such floor shall be estimated alone as determining the kind of construction under this article.

514. **Lighting Service Requirement.)** Gas or electricity or both may be used for illuminating purposes in buildings of Class IVa. Provisions shall be made to properly light every portion of a building of Class IVa and every outlet therefrom leading to the outside of the building, and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls and auditoriums used for the purpose of Class IVa provisions shall be made to furnish a light above, if possible, otherwise closely adjoining every opening to an exit or emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is 400 or less provisions shall be made to supply such light with either gas or electricity. Where the capacity of the room, hall or auditorium is greater than 400 provisions shall be made to supply such light by gas only.

Class IVb.

515. **Class IVb Defined.)** In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

516. **Frontage—Seating Eight Hundred or Less—Seating More than Eight Hundred.)** (a) Every building of Class IVb, containing a hall or halls of an aggregate seating capacity of 800 persons or less, shall have a frontage upon two public spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

(b) Buildings of Class IVb, containing halls or rooms, used for the purpose of Class IVb, of greater aggregate seating capacity than 800, shall have a frontage upon three open spaces, of which at least one shall be a public street, while the other two, if not streets, shall be public or private alleys, of a width of not less than ten feet, each opening directly on a public street or alley; provided that a fireproof passageway at grade level, and not less than seven feet in width may be used in place of one such alley, if such passageway connects with a public thoroughfare.

517. **Auxiliary Buildings—Height and Construction of—Communicating Doors.)** (a) Every building hereafter erected and connected with or made part of any building used in whole or in part for the purposes of Class IVb. shall, if sixty or less feet in height, be of fireproof mill or slow-burning construction, except as otherwise provided in this chapter, and, if more than sixty feet in height, of fireproof construction.

(b) No existing building, other than of fireproof construction, shall be connected to any building of Class IVb now existing or hereafter constructed, unless there is, between such buildings, a fire wall constructed as required by Section 732 of this chapter and extending from the ground to and through the roof.

(c) In all such cases where both buildings are not of fireproof construction, each opening in the intervening walls shall be equipped with automatic double fire-doors as required by Section 789 of this chapter.

518. **Existing Buildings—Used for Class IVb and for Other Purposes.)** No part of an existing building, other than of fireproof construction shall be used for the purposes of Class IVb unless such part is separated from all portions of the same building used for other purposes by a fire wall constructed as required by Section 732 of this chapter and extending from the ground to the roof and unless all openings in such fire wall are equipped with automatic double fire doors as required by Section 789 of this chapter; in which case such other portions may be constructed in the manner permitted for separate buildings of such class.

519. **Construction—Depending on Capacity.)** Every building used for the purpose of Class IVb, hereafter erected, containing a hall or room of an aggregate seating capacity of not more than 1,500 persons, shall be built of mill, slow-burning or fireproof construction. Every building hereafter erected to be used for theatrical purposes with a seating capacity greater than three hundred shall be built to conform to the requirements of buildings of Class V hereafter erected. If a hall or room or halls or rooms have a total seating capacity of more than 1,500 persons, such building shall be built of fireproof construction; provided, that buildings mainly used for exposition or exhibition purposes, and not used for theatrical purposes, and not exceeding two stories in height which have for public use only a main floor and one gallery and which have their walls and structural members of incombustible material and which comply with the provisions of this ordinance as to stairways, exits and fire escapes, may have their temporary seats, boxes, show cases, platforms, or booths, constructed of combustible material; provided, however, that any and all draperies, buntings, or other inflammable decorations shall be treated with a fire-retarding solution, subject to the approval of the Chief of Fire Prevention and Public Safety.

520. **Buildings in Which Seats Are Not Fixed—Seating Capacity.)** In computing the seating capacity of any room or building used for the purposes of this Class, in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVb standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of each floor shall be estimated alone as determining the kind of construction under this article.

521. **Limitations of Floor Levels—Height Above Sidewalks—Skating Rinks.)** (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVb, other than skating rinks, shall be as follows: No auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than fourteen feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVb having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVb, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVb and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than four feet wide in the clear and such floor or floors shall be equipped with emergency exits and have not less than one stairway fire escape.

(b) In buildings of fireproof construction hereafter erected, banquet halls or ball rooms having a seating capacity of not more than 900 may be located on any floor. Such banquet halls or ball rooms shall have access to at least two interior stairways and not less than one stairway fire escape, the combined width of which shall be equal to at least 18 inches for each one hundred persons for whom accommodations are provided in said banquet hall or ball room.

(c) No room or hall used for the purposes of a skating rink shall be constructed, operated or maintained with its main floor level more than two feet above the inside sidewalk grade of the street upon which such building containing same fronts, or more

than one foot above the ground level in front of such building when it does not face upon a street, or more than one foot below the inside sidewalk grade of the street upon which such building fronts, or more than one foot below the ground level in front of such building when it does not face upon a street.

522. **Allowance for Loads in Construction of Floors.)** All floors of all buildings of Class IVb shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor, in accordance with the general provisions of this chapter.

523. **Stairways—Entrances and Exits—Width of.)** The width of stairways in buildings used wholly or in part for the purposes of Class IVb, shall be 18 inches for every 100 persons of the aggregate seating capacity of all rooms used for the purposes of Class IVb in such buildings; but no stairway in such building shall be less than four feet wide in the clear; provided, that in any such building having a room or rooms, balcony or gallery, used for the purposes of Class IVb, the aggregate seating capacity of which does not exceed 250 persons, two separate and distinct stairways, each three feet wide, shall be permitted, but no such building hereafter erected shall have less than two interior stairways of the width required by this ordinance, and located as far apart as practicable. Every hall or room used for the purposes of Class IVb in a building hereafter erected, shall have access to not less than two stairways. Every stairway shall have handrails on each side thereof; stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high; no stairway shall ascend a greater height than 13 feet 6 inches without a level landing, which landing shall be not less than four feet wide measured in the direction of the run of the stairs. Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than 2 feet 6 inches wide in the clear when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

524. **Balconies and Galleries—Designation of.)** Where there are balconies or galleries, the first balcony or gallery shall be designated "balcony" and the second and third balconies or galleries shall be designated respectively "gallery" and "second gallery."

525. **Balconies and Galleries—Exit and Entrance.)** Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate required capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

526. **Aisles—Steps in Aisles—Passageways—Cross Aisles Leading to Emergency Exits.)** (a) Aisles in rooms used for the purposes of Class IVb shall have in the aggregate a width of 18 inches for each 100 of the seating capacity of such room, and for fractional parts of 100 a proportionate part of 18 inches shall be added; but no aisle shall be less than two feet six inches in width.

(b) Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors.

527. **Corridors, Passageways, Hallways and Doors—Width of.)** The width of corridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such door shall be less than three feet in width.

528. **Seats—Number in Rows.)** There shall be not more than fourteen seats in any one row between aisles, and in a room or rooms used for the purposes of Class IVb, of a seating capacity greater than 400 persons, there shall be an aisle on each side of any bank of seats, where there are over seven seats in a row. Rows of seats shall not be less than thirty-two inches from back to back and no bank of seats shall be of a greater rise than twenty inches.

529. **Emergency Exits.)** (a) Emergency exits and stairways shall be provided outside of any and all rooms used for the purposes of Class IVb which have a seating capacity larger than eight hundred, and such emergency exits shall have a width equal to one-half of the width provided for the main exits and such emergency exits shall lead directly to a public thoroughfare. Provided, however, that any room or rooms used for the purposes of Class IVb in any building hereafter erected, having a seating capacity of more than 400, shall have emergency exits outside of the walls of such building equal in width to one-half of the exits required for the main exits, and such emergency exits shall lead directly to a public thoroughfare. Doors leading to emergency exits shall not be less than three feet wide. Stairs shall not be less than four feet wide. Such emergency exits and stairways may be built inside the walls of such building of a width not less than four feet, provided that they are enclosed by a fireproof partition not less than 4 inches thick; and provided further, that the stairs themselves are constructed of incombustible material. Emergency stairways may descend into open spaces or passageways, provided they do not obstruct more than one-half of the width of such open spaces or passageways.

(b) Every stairway fire escape shall be located and constructed in accordance with the requirements of Sections 881, 882 and 885, but in no case shall any room used for the purposes of Class IVb located above the third story of any building have less than one stairway fire escape.

530. **Doors to Open Outward.)** All doors affording access directly or indirectly to the street, alley or corridor from any room used for the purposes of Class IVb shall open outward.

531. **Walls Between Auditorium and Stage.)** There shall be a solid brick wall of the same thickness as required for outside walls between the auditorium and stage in buildings hereafter erected for or converted to the use of Class IVb and used either wholly or in part for that purpose; and in existing non-fireproof buildings such wall must extend to a height of three (3) feet above the roof. Provided, however, that in existing buildings any room used for the purposes of Class IVb on or before March 13, 1911 having a greater seating capacity than four hundred (400) shall have a proscenium wall built of masonry or incombustible material.

532. **Curtain Shall Be of Iron, Steel or Asbestos—Inspection of—Fee.)** The main curtain opening in any such room shall

have a wrought iron or steel or three-ply asbestos curtain with a wire mesh imbedded therein, which shall be inspected by the Department of Building semi-annually, for which inspection a charge of five dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

533. **Structures Over Ceiling—Construction.)** If any structure intended to be occupied by people is built over the ceiling of any room, used wholly or in part for the purposes of Class IVb, the girders or trusses supporting the same shall be of steel protected with fireproofing as required for interior columns in Section 839.

534. **Standpipe and Hose on Stage.)** In every room used for the purpose of Class IVb and having a seating capacity of 250 or more, and where scenery is used, a standpipe with hose connection and hose shall be installed on each side of the stage under the direction of the Chief of Fire Prevention and Public Safety.

535. **Vents of Flue Pipes.)** (a) One or more vents of flue pipes of metal construction or other incombustible material approved by the Commissioner of Buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches, or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

536. **Fuse Boxes.)** Every fuse box shall be surrounded by two thicknesses of fireproof material with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the Commissioner of Gas and Electricity.

537. **Capacity—Certification for License.)** (a) The Commissioner of Buildings shall determine the number of persons which every room used for the purposes of Class IVb may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk.

(b) No amusement license shall be issued for any room used for the purposes of Class IVb until the Commissioner of Buildings shall first have certified, in writing, that such room complies with the provisions of this chapter in every respect.

538. **Lighting Service Requirement.** Gas or electricity or both may be used for illuminating purposes in buildings of Class IVb but the use of gas is prohibited in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of Class IVb and every outlet therefrom leading to the outside of the building, and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service, and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls and auditoriums used for the purposes of Class IVb provisions shall be made to furnish a light above, if possible, otherwise closely adjoining every opening to an exit or emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is 400 or less provisions shall be made to supply such light with either gas or electricity. Where the capacity of the room, hall or auditorium is greater than 400 provisions shall be made to supply such light by gas only.

539. **Scenery—Definition—Movable Scenery.)** (a) "Scenery" as used in this chapter shall include all scenery, drop curtains and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

"Movable scenery" shall include all scenery, drop curtains, borders and wings which are made movable for the purpose of changing scenery and substituting another set during or between the various stage acts.

540. **Scenery to be Non-Inflammable.)** All scenery or stage paraphernalia of any sort used upon the stage of any room used for the purpose of Class IVb shall, previous to such use, be treated with a fireproof solution and shall be tested and approved by the Chief of Fire Prevention and Public Safety.

541. **Amount of Scenery Allowed—Sprinkler System.)** Two sets of house scenery and three drops, exclusive of asbestos fire curtain and picture screen shall be allowed in existing rooms used for theatrical purposes in buildings of Class IVb where the same are on the first floor level, or in a building of fireproof construction or which conformed with the requirements of fireproof buildings at the time same was erected, and the same shall also be allowed in such existing rooms used for theatrical purposes above the first floor level when the seating capacity of such room does not exceed 300. Such scenery shall be known and designated upon the licenses issued by the city as "Permanent House Scenery," and the use and moving of such scenery shall not be construed as placing said building, hall, room or theater within the provisions of the ordinance relating to Class V buildings.

A set of house scenery as contemplated by this section is hereby defined to mean sufficient scenery to make one stage setting, such scenery being in continuous use in such house; provided, however, that the lowering of a drop shall not constitute a new stage setting.

No other scenery except as above enumerated shall be permitted on, above or underneath the stage.

Every existing Class IVb theatre affected by this section shall be equipped with an approved sprinkler system and also with stand-pipe and hose subject to the approval of the Chief of Fire Prevention and Public Safety.

No Class IVb theatre in existence on March 13, 1911 affected by this section shall increase its seating capacity beyond its capacity on July 22, 1912.

No scenery or stage paraphernalia of combustible materials shall be used on the stage of any room or theatre used for the purposes of Class IVb, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and all such treated scenery or stage paraphernalia, or both, shall be tested and approved by the Chief of Fire Prevention and Public Safety.

542. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing room shall be properly ventilated, as in the judgment of the commissioner of health may be required.

CLASS IVc.

543. **Class IVc Defined—Moving Picture and Vaudeville Shows—Seating Capacity.)** Class IVc shall include every building hereafter erected used for moving picture or vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred, provided that every building of Class IVc existing at the time the passage of the ordinance known as The Chicago Code of 1911 shall comply with the provisions of Class IVb. All buildings hereafter erected for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, with a seating capacity of over three hundred, and for the exhibition of moving pictures only, where the seating capacity is more than one thousand, shall be built to conform with the requirements for buildings of Class V hereafter erected as contained in this chapter. Buildings for the exhibition of moving pictures only and with a seating capacity of over three hundred, but not to exceed one thousand, shall also be built to conform with the requirements for buildings of Class V hereafter erected, in all their structural requirements and equipment except in so far as such requirements and equipment are modified in Sections 544 and 545 hereof.

544. **Frontage of Class IVc — Frontage, Open Spaces and Fireproof Passageways of Moving Picture Theatres Containing a Seating Capacity of more Than Three Hundred.)** Every room used for the purposes of Class IVc shall have a frontage upon at least two public thoroughfares, of which at least one shall be a street, and the other a street or a public or private alley not less than ten feet wide and opening directly on a public street or alley.

Buildings for the exhibition of moving pictures only, with a seating capacity of over three hundred but not to exceed one thousand, shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten feet in width. Except as hereinafter otherwise provided, the audience room of such building shall have either a public thoroughfare or an open space unobstructed from the ground to the sky on each side thereof. Such open space, when the audience room has a capacity not to exceed six hundred seats, shall be five feet wide, and six inches shall be added to the width of same for every additional one hundred seats in said audience room up to the maximum of one thousand seats. In all cases where there is a public alley in the rear of such building, said open space must connect directly with the alley. In case the entire audience is seated on the ground level said open spaces shall extend alongside of the audience room so as to connect with exit doors placed approximately in the middle of the audience room between the opposite ends of same. Where there is a balcony or gallery installed, such open spaces must extend along the entire length of the audience room so as to connect with exits from the balcony or gallery at their highest and lowest levels. Where such a building is located on a corner lot and adjoins a public street on one side and a public street or an alley not less than ten feet wide on two of the remaining sides and the building is so located that it adjoins such public thoroughfares on three sides for its entire extent, it shall not be necessary to construct an open space on the remaining side thereof, but in all such cases there shall be either an open space unobstructed from the ground to the sky or a fireproof passageway at least five feet wide leading from the side of the audience room not bordering on a street or other public space to the street in front of the theatre and another leading to the alley or other public space in the rear of the theatre. If the seating capacity of such theatre is over six hundred, six inches shall be added to the width of such open space or passageway for every one hundred seats or fraction thereof in excess of six hundred and up to the maximum of one thousand. If access to the street and alley or other public space as herein provided is by means of a fireproof passageway, such fireproof passageway must be constructed in all respects according to the provisions of Section 610 except as herein otherwise provided.

545. **Construction.)** Buildings of Class IVc hereafter erected, of a seating capacity not to exceed three hundred, shall not be built more than thirty feet in height and may be built of ordinary construction, but the enclosing walls shall be constructed of masonry. No moving picture, vaudeville or theatrical show shall hereafter be installed in a frame building. No room or hall used for the purposes of Class IVc shall hereafter be installed underneath any living or sleeping room.

Buildings for the exhibition of moving pictures only with a seating capacity of more than three hundred but not to exceed one thousand, when the same shall be located as provided for in Section 544 hereof, may be built as herein provided. Said buildings shall contain no stage, proscenium wall nor scenery of any description. The screen for the display of the pictures must be attached to the rear wall of the building, not to exceed six inches away from same. No decorative walls or paintings or other effects shall be constructed inside the audience room in such a manner as to allow any rooms or spaces between same and the enclosing walls of the building. An open platform not to exceed seventy-two square feet in area may be built before the picture screen. On the main floor of such building there shall be at least two main aisles with direct exits at front and rear and two cross aisles with direct exits from the side. When such building contains a balcony or gallery there shall be emergency exits from the highest and lowest levels of same on one side and on the other side there shall be either emergency exits or enclosed interior stairs from the highest level of the balcony, and the lowest level of the balcony shall be connected with such side stairs by means of a tunnel. All seats in the audience room shall be at least twenty inches wide and space thirty-four inches from back to back. The booth for the moving picture machine must be of construction in conformity with the requirements for such machine booths in buildings of Class IVc; in all other respects such buildings shall comply both in structural requirements and equipment with the provisions of this chapter relating to theatres of Class V hereafter erected.

Provided, however, that where such building has no balcony or gallery and the seats in the audience room are all on the ground floor of same, and where no portion of the building connected with or made a part of or used in conjunction therewith exceeds two stories in height, and where the lobbies and entrances leading to such part of the building used for purposes of Class IVc have brick dividing walls separating them from the portions of the building connected therewith used for the purpose of any other class as defined in this ordinance, and the floors of said lobbies and entrances and the floors and ceilings above such lobbies and entrances are of fireproof construction and there are no doors or windows leading from such lobbies and entrances to any portion

of the said building used for any other purpose than Class IVc, such portion of said building as is not used for purposes of Class IVc may be built in accordance with the provisions of this chapter designating the manner of construction for such classes.

546. **Floor Levels—Limitations.)** The following limitations of floor levels shall apply to every building used for the purposes of Class IVc; the highest part of the auditorium floor shall not exceed four feet above the sidewalk level. The floor level at the entrance shall not be at a greater height than eight inches above the sidewalk. The aisles shall not have a greater incline than 1½ inches to the foot.

547. **Stairways.)** Where external stairways are required, such stairways shall be at least six inches wider than the exits, and shall have treads not less than ten inches wide and risers not more than 8 inches high, and shall be provided with suitable handrails on each side thereof, and the width of such stairs shall comply with the requirements of Class IVb.

548. **Balconies and Galleries.)** In non-fireproof buildings hereafter erected for, or converted to the purposes of Class IVc, not more than one balcony and no galleries shall be constructed.

549. **Width of Aisles—Steps in Aisles.)** Aisles and rooms used for the purpose of Class IVc shall have in the aggregate a width of not less than twenty inches for each 100 of seating capacity of such room and for fractional parts of 100 a proportionate part of twenty inches shall be added, and no aisles shall have a width of less than two feet six inches. When side emergency exits are permitted, there shall be a cross aisle not less than three feet wide, leading directly to said exit. Steps shall not be permitted in any aisle or in any portion of the auditorium floor.

550. **Corridors — Passageways — Doors — Width Of.)** The width of corridors, passageways and doors shall be computed in the same manner as provided in Sections 526 and 527.

551. **Seats—Size—Location.)** There shall not be more than ten seats in any one row between aisles, nor more than six seats between an aisle and side wall. Seats shall not be less than thirty-two inches from back to back and shall not be less than twenty inches in width measured at the top of the seat back, and shall be secured firmly to the floor.

552. **Exits.)** In every building of Class IVc, there shall be provided at least two entrance doors. No entrance doors shall be less than four feet in width. If the rear of the building abuts upon an alley, there shall be provided not less than two emergency exits leading directly to the said alley. Wherever emergency exits pass over or under the stage floor level, they shall be enclosed with walls of masonry nine inches in thickness, or four-inch hollow tile, or of two-inch solid plaster, composed of iron studs and metal lath and plaster, and shall have floors and ceilings of slow-burning mill, or fireproof construction. If the side of the auditorium abuts upon a street or alley, such emergency exits shall be located as follows: one exit shall be located at a distance not greater than five feet from the proscenium wall or stage, and the other exit shall be located at a distance half way between the foyer and the stage wall. Exits by means of stairways or stairway fire escapes, equal in width to eighteen inches for each one hundred persons, shall be provided, and for fractional parts of one hundred, proportionate part of eighteen inches shall be added. No such exit shall be less than two feet six inches in width.

553. **Doors to Open Outward.)** All doors affording ingress or egress in buildings of Class IVc shall open outward, and no door shall be less than three feet wide. Such doors shall be so constructed that they may be easily opened from within.

554. **Walls Between Auditorium and Stage.)** Where the area of the stage exceeds 72 square feet, there shall be provided a proscenium wall of solid masonry of not less than nine inches in thickness, extending from ground to the roof. Where the stage area is less than 72 square feet its proscenium wall may be constructed of two-inch solid plaster walls, composed of metal studs and metal lath and plaster or three-inch hollow tile. In no case shall the underside of ceiling or roof over stage house behind proscenium wall be at a higher level than three feet over the highest point of main proscenium opening. And there shall be no trap doors or other openings in the stage floor.

555. **Curtain.)** (a) The main curtain in the opening of the proscenium wall shall be composed of long fibre asbestos twisted on brass wire and woven into a close cloth. The laps shall be sewed with two lines of brass and asbestos stitching, which laps shall not be less than one-inch wide. Said cloth shall be lapped at least four times around the top and around the bottom bars with at least three lines of the stitching above specified.

(b) The edge of the curtain shall be continuously reinforced by lapping and stitching and also with pieces of sheet metal for clips. The curtain shall be at least thirty inches wider and higher than the masonry opening, and shall have steel top and bottom bars of not less than two square inches in cross section which bars shall be connected by four three-sixteenth-inch steel cables.

(c) There shall be three-eighth-inch spanning cables with upper ends secured to steel brackets fastened to the wall and the lower ends sufficiently counter-weighted to keep the cables taut and where cables pass through the stage floor, the holes shall be metal bushed.

(d) The curtain shall have hard wood eyelets not over eighteen inches center to center, around the standing cables on both vertical edges, which eyelets shall be secured to the curtain by bent brass clips riveted to the curtain with double sheet metal reinforcing.

(e) There shall be steel lifting cables, one-half inch in diameter, at each end of the curtain and at intermediate points not over ten feet apart attached to drums on shafts located above the curtain.

(f) The operating machinery shall be built according to good mechanical engineering practice.

(g) There shall be emergency chains midway between the lifting cables, to hold the curtain which shall be equal in strength and efficiency to the lifting cables.

(h) There shall be steel guides of not less than three-eighth-inch metal on each side of the curtain from the stage floor to the level of the overhead sheaves. The metal guides shall lap the edges of the curtain not less than four inches. The curtain shall be incombustible in all its parts and its operating devices.

(i) The painting and the manner of tripping the curtain and the number of and the location of places for tripping shall be subject to the approval of the Chief of Fire Prevention and Public Safety.

(j) A permit shall be obtained from the Department of Buildings for the erection of each such curtain. The Commissioner of Buildings shall inspect each such curtain semi-annually for which semi-annual inspection, a fee of $5.00 shall be charged.

556. **Other Openings in Stage Walls.)** Every other opening in the proscenium wall or in the other walls of the stage shall have self-closing incombustible doors.

557. **Structure Over Ceiling—Construction.)** A structure may be built over the ceiling or roof of any building used wholly or in part for the purposes of Class IVc, provided such space is not used for sleeping or living purposes. Girders or trusses supporting same shall be of steel protected by fireproofing as required in Section 839 and the entire ceiling shall be covered with incombustible material subject to the approval of the Commissioner of Buildings.

558. **Picture Machine Booth.)** The walls floor and ceiling of every moving picture booth or machine house shall be built of four-inch hollow tile or four-inch solid concrete, supported on iron beams or columns, the door of operating room to be metal clad and swing outwards. There shall be a metal smoke or flue pipe eighteen inches in diameter extending from ceiling to three feet above roof of machine house and terminating in the open air outside of building.

559. **Standpipes and Hose on Stage.)** Where the stage area exceeds seventy-two square feet and any scenery is used on stage, there shall be a standpipe system installed on said stage subject to the approval of the Chief of Fire Prevention and Public Safety.

560. **Vent or Flue Pipe Over Stage.)** (a) When the stage exceeds seventy-two square feet in area and combustible scenery is used, one or more flue pipes of incombustible material and equivalent to one-twentieth of the area of the stage shall be built over the stage and shall extend eight feet above the highest point of roof.

(b) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

561. **Capacity—Certification for License.)** The Commissioner of Buildings shall determine the number of persons any room used for the purposes of Class IVc may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk.

562. **Lighting Service Requirement.)** Gas or electricity or both may be used for illuminating purposes in buildings of Class IVc but gas shall not be used in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of Class IVc and every outlet therefrom leading to the outside of the building, and all open courts, passageways, and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent system or circuit or service, and shall be controlled separately and exclusively by a switch or a shutoff located near the main entrance. In rooms, halls or auditoriums used for the purposes of Class IVc provisions shall be made to furnish a light supplied by gas, above if possible, otherwise closely adjoining every opening to an exit or to an emergency exit from the room, hall or auditorium. Where the capacity of the room, hall or auditorium is greater than three hundred, provisions shall be made to furnish a light supplied by electricity and on the same circuit as the corridor and vestibule lights, above if possible, otherwise closely adjoining every opening to an exit or an emergency exit from such hall or auditorium, in addition to the gas light in such location previously required.

563. **Lighting in Theaters—Test of Sufficient Light—Penalty.)** Every portion of a moving picture theater, including exits, courts and corridors, devoted to the use or accommodation of the public shall be so lighted by electric light during all exhibitions and until the entire audience has left the premises that a person with normal eyesight shall be able to read Snellen standard test type 40 at a distance of twenty feet; and type 30 at a distance of ten feet; normal eyesight meaning ability to read 20 at a distance of twenty feet in daylight. Cards showing types 20, 30, and 40 should be displayed in the corridor of every such theater together with a copy of this ordinance. Any person, firm or corporation that violates, neglects or refuses to comply with, or resists or opposes the enforcement of this section, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense, and shall be deemed guilty of a separate offense for every day on which such violations, neglect or refusal shall continue.

564. **Scenery Shall Be Stationary—Approval—Metal and Asbestos Scenery.)** All scenery on the stage shall be made stationary, and shall consist of not over two asbestos curtains, three stationary wings on each side and four stationary border drops. All scenery and stage paraphernalia shall be treated with a fire-retarding solution subject to the test and approval of the Chief of Fire Prevention and Public Safety. Where all scenery is made of metal upon metal supports, metal frames, and metal attachments or where all scenery is of pure long fibre asbestos twisted on brass wire and woven into a close cloth with metal framings, metal supports and metal attachments, it shall not be considered as scenery within the meaning of the term as used in this chapter.

565. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

566. **Frontage Consents Required.)** No building of this class shall hereafter be constructed for, or converted to the use of said class, unless frontage consents are secured as required by the ordinances of the City of Chicago and filed with the Commissioner of Buildings.

CLASS IVd

567. **Class IVd Defined.)** In Class IVd shall be included every grand stand and every baseball, athletic and amusement park.

568. **Loads—Allowance for Live Loads.)** The floors and stairs of grand stands and bleacher stands, existing or hereafter built, shall be designed and constructed in such manner as to be capable of bearing in all their parts and supports, in addition to the weight of the floor construction, partitions and permanent fixtures, that may be set upon the same, a live load of not less than one hundred pounds for every square foot of surface of said floors, and a live load of not less than one hundred and fifty pounds for every square foot of the bearing surface of the stairs.

569. Grandstands—Frame within Fire Limits—Grandstands Hereafter Constructed — Fireproof — Frontage — Consents.) (a) Wooden grandstands or tiers of seats commonly known and described as grandstands now constructed or in the process of construction may be erected, repaired or enlarged within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure. All grandstands hereafter erected within the fire limits, except as hereinafter provided, shall be made of fireproof or unprotected steel construction. The enclosing walls, if enclosed, shall be made of fireproof or incombustible materials, but the seats may be made of wood. Grandstands outside the fire limits, or inside the fire limits where the seating capacity does not exceed five thousand persons, may be constructed of wood, but no part of any such structure shall be within less than sixty feet of any other building or structure. The braces, supports and the underside of all seats, including bleacher seats, shall be treated with a fire-retarding solution once a year before opening up the premises containing such stand to the public.

(b) Every person, firm or corporation desiring a permit for the construction of a grandstand, except in connection with such as are now in existence, shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of the street or streets on each side of the block or square in which it is desired to erect such grandstand.

(c) The Commissioner of Buildings shall inspect or cause to be inspected all tiers of seats and grandstands each year before same are opened to the public for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. A fee shall be charged for such annual inspection as follows:

Where the seating capacity is 5,000 or less the fee shall be $10.00.

Where the seating capacity is more than 5,000 the fee shall be $25.00.

570. Width of Aisles and Exits—Number of Seats Between Aisles.) (a) The width of aisles and exits in all grandstands contemplated in Section 567, hereafter constructed, shall in no case be less than 36 inches and such width shall be increased toward the exits which serve as regular entrances, such width being computed at the rate of eighteen inches per 100 seats or fractional part thereof in non-fireproof grandstands, and at the rate of twelve inches for each 100 seats or fractional part thereof in fireproof grandstands.

(b) The number of seats between aisles in any row shall not exceed twenty in non-fireproof grandstands, nor thirty in fireproof grandstands.

571. Temporary Seating Structures.) Temporary seating structures for shows and outdoor exhibitions and the observation of holidays and special occasions may be built of combustible material, providing they are built structurally strong enough to support a live load of one hundred pounds per square foot, and comply with the provisions of Class IVb in regard to means of exit, aisles and rows of seats; and provided, further, that a permit be secured from the Commissioner of Buildings, which shall in no case be issued by him until the party desiring to erect said temporary seating structure shall secure the written consent of a majority of the property owners or their duly authorized agents, on both sides of the street on which said temporary seating struction is to be located in the block between the two nearest intersecting streets. Any permit issued for any such temporary seating structure as hereinabove provided for in this section shall not entitle the person so receiving said permit to use said temporary seating structure for more than ten consecutive days from the first day on which it is so used; and any temporary seating structure provided for in this section shall be removed within ten days after the use of the same as provided for in this section, and if not so removed it shall be the duty of the Commissioner of Buildings to order the same to be removed or torn down by the Fire Marshal at the expense of the owner thereof.

572. Use of Roofs—Requirements.) Wherever the roof of any building is used for any purposes whatever, except as a covering for the building, it shall be considered as a story of the building and subject to such restrictions of use and such requirements of construction as are provided for the building by the ordinances of the City of Chicago.

Amusement Parks.

573. Frontage Consents Required.) It shall hereafter be unlawful for any person, firm or corporation, to build, construct, establish, produce or carry on, any amusement within any ground, garden or enclosure of the kind commonly known and described as amusement parks, wherein shows of different classes are offered or presented by one or more concessionnaries, without first securing written frontage consents as required by the ordinances of the City of Chicago. Such frontage consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the construction of any building or structure connected in any way with such amusement or amusement park.

574. Requirements.) (a) Buildings erected after March 13, 1911 within an amusement park, located outside the fire limits, shall comply, except as herein otherwise sepcified, with the provisions of Class IVb.

(b) Buildings erected after March 13, 1911 within amusement parks located outside of the fire limits and not exceeding one story in height and which do not contain more than one balcony may be built with a self-supporting steel frame designed as required by this chapter. Such structures may be enclosed with metal lath covered with cement plaster, which plaster shall be not less than one and one-third inches thick, or such structures may be enclosed with galvanized iron. The roofs of such structures may be of ordinary construction supported on steel trusses and covered with a gravel or composition roof, approved by the Commissioner of Buildings.

(c) Every moving picture theatre hereafter built within an amusement park shall comply with the provisions of Class IVc.

575. Open Space Between Buildings.) There shall be an open and unobstructed space of not less than four feet between each and every frame building erected after March 13, 1911, in an amusement park, where the buildings do not exceed twenty feet in height, and of not less than six feet where the buildings are over twenty feet and less than thirty feet in height, and of not less than ten feet when the buildings are over thirty feet in height. Where brick or concrete or other fireproof walls of full seventeen inches in thickness are used between such buildings and where such buildings are built of slow-burning construction, these spaces shall not be required, but, in such cases, there shall be a space of ten feet in width at intervals of every two hundred feet.

576. Roller Coaster Devices.) No roller coaster, scenic railway, or other riding, sliding, or rolling device, shall be hereafter erected of a greater height from the ground than 55 feet. All such coasters, railways, riding or other devices shall be equipped

with safety clutches. The cars, or any receptacles, which persons are permitted to occupy, or in which they are permitted to travel, ascend or descend, shall have hand rails of sufficient number and height to prevent people from being thrown therefrom, and of such character as shall be approved by the Commissioner of Buildings.

577. **Roller Coasters—Scenic Railways, Etc.—Permit Fee—Certificate of Test and Safety.)** (a) Before any roller coaster, scenic railway, water chute or other mechanical riding, sailing, sliding or swinging device is erected, either in existing or new amusement parks, a detailed plan shall be submitted to the Commissioner of Buildings, for his approval or rejection, and, if approved, a permit shall be procured by the person, firm or corporation desiring to erect such device. The permit fee shall be fifty dollars for each such device. Before such device is opened to the public each season, a certificate of inspection, signed by a competent engineer, approved by the Commissioner of Buildings, must be furnished, certifying to the practicability, strength and safety of such devices, and such device shall be examined by the Commissioner of Buildings or his employees upon completion and also each year before the opening up to th public.

(b) The Commissioner of Buildings shall inspect or cause to be inspected all buildings to be used for purposes of exhibition, amusement or entertainment which are attended by the public that are within or connected with an amusement park, each year before said buildings are open to the public, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. The fee for such annual inspection shall be five dollars for each building so inspected.

(c.) The Commissioner of Buildings shall inspect or cause to be inspected all amusement devices, mechanisms and structures other than riding devices and other than buildings within an amusement park, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings; and the fee for such annual inspection shall be ten dollars for each device, mechanism and structure so inspected.

(d) The Commissioner of Buildings shall inspect or cause to be inspected all amusement devices operated by animals or by other motor power and all other riding, sliding, sailing, swinging or rolling devices situated on any lot or tract of land outside of the amusement park before said devices are open to the public. Where said devices are taken down, removed and reassembled or re-erected in another location, the Commissioner of Buildings shall inspect or cause said devices to be reinspected after each removal and before said devices are open to the public, for the purpose of ascertaining whether they comply with the City ordinances and the rules and regulations of the Department of Buildings. A fee of five dollars shall be made for every such inspection or re-inspection.

578. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct, alter or operate any amusement park or any building or structure therein unless they comply with the ordinances of the city relative thereto.

ARTICLE VIII.
Class V.

579. **Class V Defined.)** In Class V shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical presentation, shall not be considered as public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IV as defined in this chapter.

Whenever words are used in the articles of this chapter which relate to the classification of Class V buildings into buildings in existence and buildings hereafter erected, such words (unless expressly shown to be intended otherwise) shall be understood as referring to the date July 18, 1905, at which time the original ordinance making such classification was passed by the city council.

580. **Must Comply with General and Special Provisions.)** In addition to the provisions of this article every building of Class V shall also comply with the general provisions of this chapter.

581. **City Officers Empowered to Enter Buildings.)** The Commissioner of Buildings, Commissioner of Health, Fire Marshal, Chief of Fire Prevention and Pubic Safety, Commissioner of Gas and Electricity, Superintedent of Police, or any of them, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class V, and any and all parts thereof, at any reasonable time and at any time when occupied by the public, in order to examine such buildings, to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

582. **City Officers Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Marshal, Chief of Fire Prevention and Public Safety, Commissioner of Gas and Electricity, Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Cass V, closed, where it is discovered that there is any violation of any of the provisions of the chapter, and keep same closed until such provisions are complied with.

583. **License—Mayor Shall Revoke.)** Upon a report to the Mayor by the Commissioner of Buildings, Commissioner of Health, Fire Marshal, Chief of Fire Prevention and Public Safety, Commissioner of Gas and electricity, or the Superintendent of Police that any requirement of this chapter or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theatre or place of amusement so reported and cause the same to be closed.

Buildings of Class V Now in Existence.

584. **Buildings of Class V Now in Existence.)** The following provisions shall apply to Class V buildings in existence at the time of the passage of this ordinance:

585. **Walls—Outside—Must Comply with Requirements of Section 732.)** The outside walls of all such buildings in existence at the time of the passage of this ordinance, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more shall comply with the requirements of Section 732.

586. **Columns in Walls—Alterations.)** If iron or steel columns are introduced in the walls referred to in Section 585 the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed as provided in Sections 838 and 839 of this chapter. All alterations in such existing buildings, to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings; provided, that after the said building is brought into compliance with the provisions of this chapter, then all subsequent alterations, enlargements, repairs, replaced or strengthened structural parts damaged by fire, wear and tear, or otherwise, shall be made of fireproof construction or iron or steel construction covered with fireproof materials, as provided by this chapter.

587. **Other Classes Built in Conjunction with Class V—Doors for Openings Between Connecting Buildings.)** In all cases where existing buildings used wholly or in part for the purposes of Class V are built in conjunction with or as part of buildings devoted to the uses of other classes and where such buildings of the other classes, as specified in this ordinance, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V and the building connected therewith.

588. **Floor Levels—Limitations of.)** (a) Any audience room used for the purposes of Class V now in existence containing in the aggregate not more than five hundred seats, if in a fireproof building, may be maintained in any story thereof, but in such case there shall be at least two stairways to the ground, from the floor or floors on which each such room is located, each of which stairways shall be not less than four feet in width in the clear.

(b) In existing buildings of fireproof construction, having an audience room with a seating capacity of more than five hundred and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this ordinance. The main floor of any existing theatre of any kind of construction shall not be raised above its present elevation.

589. **Loads—Allowance for Live Loads in Construction of Floors of Class V.)** For all buildings of Class V all floors shall be designed and constructed in such manner as to be capable of supporting in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

590. **Stairways—Entrances and Exits.)** (a) Stairways, affording egress from any room or rooms used for the purposes of Class V shall be equivalent in width to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches shall be added, but no such stairway shall be less than four feet wide in the clear, except as hereinafter provided in this section.

(b) All such stairways shall have hand railings on each side thereof and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs. No run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails with end newel posts at least 5½ feet high.

(c) Steps shall not have a greater rise than 8 inches, treads shall not be narrower than 10 inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

(d) In existing theatres every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theatre is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails, three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

(e) There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Every stairway leading to a box or boxes shall be independent of all other stairs or seats: and such stairway shall not be less than two feet eight inches wide in the clear, when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

(g) Every stairway on the stage side of the proscenium wall shall be not less than two feet six inches wide.

(h) Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theatre shall have the privilege of reducing the number of permanent seats therein until the same ratio between such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theatre shall be issued.

591. **Floors and Exits.)** Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

592. **Seats in Rows Between Aisles.)** (a) Not more than ten seats in any row shall be permitted between aisles in any gallery. On the main floor and balcony not more than eleven seats shall be permitted between aisles; except in rows of seats which are within twenty feet from the exits, in which case thirteen seats shall be permitted between aisles.

(b) Seats shall be not less than twenty inches in width measured at the top of the seat backs. Rows of seats shall be not less than two feet eight inches from back to back.

No bank of seats shall be of greater rise than twenty-two inches.

(c) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, except that groups of

five seats or less may abut upon a tunnel at one side and an aisle at the other. And except that a bank of seats abutting boxes or walls on main floor, balcony, and gallery, of not over five seats in a row, shall be required to abut upon one aisle only.

(d) The number of banks of seats on the main floor shall not exceed fifteen unless an intervening or cross aisle is provided between each fifteen banks of seats or unless a direct exit is provided for each aisle.

(e) The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or unless a direct exit be provided for each aisle.

593. **Limits of Vertical Rise and Requirement for Tunnels in Cross Aisles—Openings in Foyer Wall.)** (a) There shall be no more than twelve feet rise measured vertically in any aisles in any floor or in any balcony or in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

(b) There shall be no openings in the foyer wall between the foyer and theatre proper other than the exit openings.

594. **Main Floor—Balcony and Gallery—Designation of.)** (a) The lower floor of all theatres shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

595. **Aisles—Width of—Shall Lead Direct to Exit—Steps in Aisles.)** (a) The minimum width of aisles with diverging sides in any room used for the purposes of Class V shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

(b) The minimum width of aisles with parallel sides shall be three feet.

(c) Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto.

(d) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be greater than 8 inches, and no tread shall be less than 10 inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

596. **Corridors, Passageways, Hallways and Doors—Width of.)** (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall lead directly to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not have locks or catches of any kind whatever.

597. **Doors—Entrance.)** (a) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each one hundred permanent seats in the audience room and in addition thereto a proportionate part of twenty inches for the fractional part of one hundred seats shall be added.

(b) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, window, exit, hallway or corridor where none exists.

598. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

599. **Emergency Exits — Width — Emergency Stairs—Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.)** (a) Emergency exits and stairways shall be provided separately for each floor, balcony and gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency stairways shall be made of iron, steel, or other incombustible materials. Such emergency exits shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fire-

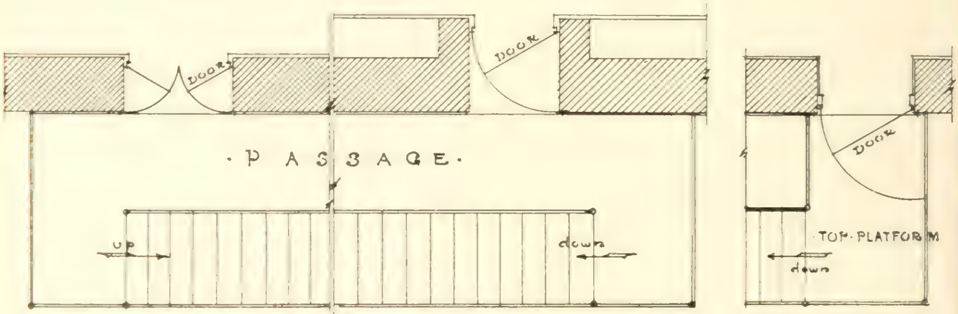

Fig. 3.
EMERGENCY EXITS.
Section 599.

Suggestion how to swing doors, so as not to obstruct passageway.

proof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

(c) If said emergency exits lead outside the building, the opening leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall. Outside shutters will not be permitted, except when they open automatically from the interior, without resistance, and when used or open will automatically fasten, securely, flat against the wall, so as not to obstruct the passage on the outside; all such automatic devices or attachments to said doors or shutters shall be subject to the approval of the Commissioner of Buildings and the Chief of Fire Prevention and Public Safety.

(d) Whenever any such emergency stairway passes over an exit door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley, or street, without entering into or passing through or over any building unless by a fireproof passage at least four feet wide and seven feet high on the court or ground level.

(g) All doors in openings from any and all exits and stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

600. **Proscenium Wall—Curtain—Requirements for Other Openings in Proscenium Wall.)** (a) There shall be in every theatre a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage side, which shall be raised and lowered by mechanical power and shall be in constant use as the regular curtain and act drop.

(b) No combustible material other than painted decorations shall be applied to the audience side of such curtains.

(c) Plans for such curtains shall be approved by the Commissioner of Buildings and a permit obtained previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, for which inspection a fee of five dollars shall be charged.

(d) All other openings in such proscenium wall shall have iron doors, frames and thresholds.

601. **Stage — Construction of — Framing for Scenery.)** The framing for the floor of every stage shall be of iron, steel, or reinforced concrete. The stage floor may be of wood not less than one and three-quarters inches thick, provided the underside of stage floor shall be saturated with a fireproof solution satisfactory to the Chief of Fire Prevention and Public Safety. The entire floor construction and the floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports, shall be of iron, steel or reinforced concrete. All framing for scenery and all stage paraphernalia shall be saturated with a fireproof solution the same as prescribed for stage flooring.

602. **Vestibule for Stage Doors.)** All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings so as to protect the curtain, scenery and auditorium against draughts of air.

603. **Vents—Flue Pipes, Size of—Dampers—Switches for Dampers.)** (a) One or more vents, or flue pipes, of metal construction or other incombustible material, suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a fused cord and by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them fail to operate. Such stations shall be located in such places on the stage as may be determined by the Chief of Fire Prevention and Public Safety, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

604. **Automatic Sprinklers.)** (a) A system of automatic sprinklers subject to the approval of the Chief of Fire Prevention and Public Safety, shall be provided and installed in every theatre.

(b) Where water for such system of automatic sprinklers is supplied from a tank, the supports and installation of such tank or tanks shall be subject to the approval of the Commissioner of Buildings.

605. **Lighting Requirements — Buildings Class V Now in Existence.)** Lighting of every building of Class V, whether now in existence or hereafter erected, shall comply with the requirements for buildings of Class V hereafted erected.

606. **Capacity — Certificate for License.)** The Commissioner of Buildings shall determine the number of persons which every room used for the purpose of Class V may accommodate according to the provisions of this chapter and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

607. **Theatres in Frame Buildings Prohibited.)** No frame building, or part thereof, within the city, shall be used as a moving picture, vaudeville or other theatre; provided, that nothing herein contained shall be held to apply to any frame building existing at the time of the passage of this ordinance and in which a moving picture, vaudeville or other theatre is being maintained at the time of the passage of this ordinance, where all the scenery, if any, used in connection with such moving picture, vaudeville or other theatre,

is constructed of either sheet-metal or asbestos, and where the amount of exit space for such theatre is at least fifty (50) inches for each one hundred (100) seats therein contained, and where there is no living apartment of any kind used, maintained or occupied as such in any part of said building.

BUILDINGS OF CLASS V HEREAFTER ERECTED.

608. **Buildings of Class V Hereafter Erected.)** The following provisions shall apply to buildings of class V hereafter erected and used wholly or in part for such purposes:

609. **Construction—Walls—Outside Walls—Structures.)** All buildings of Class V hereafter erected shall be built of fireproof construction.

610. **Frontage — Open Spaces — Fireproof Passageways.)** (a) All buildings hereafter erected used wholly or in part for the purposes of Class V shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten (10) feet in width.

(b) The audience room of every such building used for the purposes of Class V shall have either a public thoroughfare or an open space not less than ten feet wide extending from the lowest first floor level to the sky, on each of the two sides other than the proscenium and the foyer. Exit doors shall open onto such public thoroughfare or the bottom of such open space from the respective sides of the stage and of the main floor of the audience room, and onto balconies or platforms built in such public thoroughfare or open space at both the highest and the lowest floor levels of each and every balcony and gallery and the doors opening into such public thoroughfare or open space from any balcony or gallery or from the main floor shall comply with all the requirements prescribed in Section 618 of this chapter.

Provided, however, where such building has a seating capacity of not to exceed 1,000 persons, and in which the seats for the entire audience are located upon the main floor, and where no part of the main floor is higher than four (4) feet above the inside sidewalk grade of the street opposite the main entrance to such building, and where every part of every building connecting thereto or built in conjunction therewith is of fireproof construction, the provisions for open spaces alongside audience room as contained in Section 544 applicable to buildings of Class IVc where the entire audience is seated on the ground level shall govern with respect to open spaces, and the provisions of Section 545 shall govern with respect to main floor aisles and direct exits from same.

Provided further that two theatres are erected simultaneously in the same building or in adjoining buildings under the same ownership, and where the aggregate seating capacity of both theater audience rooms taken together does not exceed a total of 2,500 persons, and where said building or adjoining buildings have a frontage upon three public thoroughfares, the said audience rooms may have in common an open space not less than ten feet in width in every part thereof from the line of the proscenium wall along and directly adjacent to each audience room to the public street upon which such building or buildings face. Such open space shall be clear and unobstructed from the bottom thereof to the sky, and may be considered the equivalent of an open space for each audience room as required by this section.

(c) All such balconies or platforms as are required by this section shall be connected with stairway fire escapes leading to the street level or to the bottom of such open space and in the latter case they shall have their bottom run toward the public thoroughfare and such balconies or platforms and such fire escapes shall comply with all the requirements prescribed in Sections 881, 882 and 885 of this chapter. Every such open space, if it does not open into a public thoroughfare shall communicate with the public thoroughfare at the front side of the theatre by a fireproof passageway leading from the bottom level of such open space to the sidewalk level. Where there is a public thoroughfare behind the stage every such open space shall also communicate with such public thoroughfare by a fireproof passageway leading from the bottom level of such open space to the level of the public thoroughfare behind the stage, and passing under the stage.

(d) The walls of a fireproof passageway shall not be less than four inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the general provisions of this chapter relating thereto.

(e) Radiators for warming passageways shall be in recesses sufficient in depth to prevent them from obstructing the passageway.

(f) There shall be no steps or risers in fireproof passageways, but where necessary, inclined floors of the full width of the fireproof passageway may be built; the incline of the floor shall not exceed two and one-half inches in height per foot measured horizontally, and no such incline shall be less than ten feet in length. No fireproof passageway shall be less than ten feet wide and eight feet high in any part thereof except at doors, and these door openings shall be not less than eight feet wide and seven feet high.

(g) If the principal entrance corridor of a theatre is at one side and approximately at right angles to the central axis of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage, on said center axis of the stage and the audience room and at a point midway between such seat and the wall opposite the proscenium wall.

611. **Buildings of Other Classes Built in Conjunction with Class V.)** If buildings used wholly or in part for purposes of Class V, are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built of fireproof construction.

612. **Floor Levels — Live Loads.)** (a) The floor level of the highest bank of seats on the main floor shall not be more than three feet above the sidewalk level and the floor level of the lowest bank of seats on said floor shall not be more than eight feet below the sidewalk level.

(b) All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

613. **Stairways — Entrances and Exits.)** (a) Stairways affording ingress to or egress from any room used for the purposes of Class V shall be in width equivalent to twenty inches for each one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added but in no event shall any such stairways be less than four feet in the clear, except as hereinafter provided.

(b) All such stairways shall have hand rails on each side thereof, and shall no

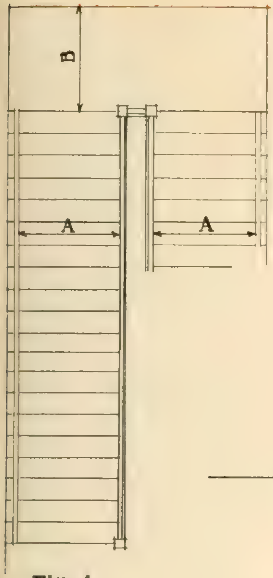

Fig. 4.

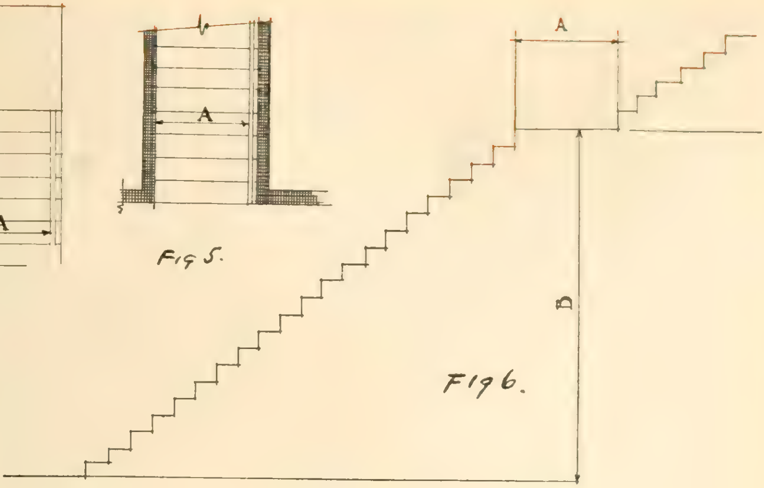

Fig 5.

Fig 6.

STAIRWAYS.

Sections 551, 656, 664, 667, 701, 878, 880 and others.

Fig. 4 (A) Shows measurement of stairways where hand rails are required on each side.
(B) Shows measurement of landing.

Fig. 5. Measurement of stairway where hand rail is required on one side only.

Fig. 6 (A) Landing.

(B) Stairways shall not ascend to an unlimited height (B) without a landing (A), and (A) shall not be less in width and length than (A) Fig. measurement of stairs.

Fig. 7.

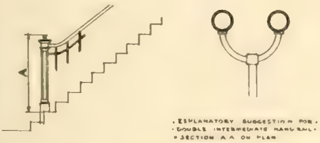

Fig. 8.

Fig. 7. Over 7′ 0″ (for exceptions see ordinance) wide stairways (C) shall have double intermediate hand rails (Fig. 7). In plan (Fig. Sec. AA).
(B) Measurement of stairs where double intermediate hand rails occur.
(C) Measurement of stairs where double intermediate hand rails do not occur, as in general case, Fig. 4 (A).

Fig. 8. Newel post 5½′ 0″ high (A) required for stairs as referred to in Fig. 8.

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ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

(c) Steps shall not have a greater rise than eight inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase.

(d) Every balcony and gallery shall have one or more separate and distinct exits and stairways to the sidewalk level. All gallery stairways shall lead to the top gallery and there shall be doors in same at each floor for exit purposes only. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the buildings, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

(e) There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairway may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five persons for whom seating capacity is provided, or major portion thereof, in such box or boxes there shall be an additional five inches in width of such stairway.

(g) All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

614. **Floors at Exits — Seating.)** (a) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

(b) There shall not be more than ten seats in any one row between aisles.

(c) Seats shall be not less than twenty inches in width, measured at the top of the seat backs

(d) Rows of seats shall not be less than two feet ten inches from back to back.

(e) No bank of seats shall have a greater rise than twenty inches. A bank of seats abutting boxes or wall on main floor, balcony or gallery of not over five seats in a row, shall be required to abut upon one aisle only.

(f) Seats in loges and boxes shall be limited in the ratio of one seat for every six hundred and eighty square inches of floor area in such loge or box.

(g) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle on the other side.

(h) The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" and "galleries" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

615. **Limit of Rise in Floor — Opening in Foyer Wall.)** (a) There shall be no more than eleven feet rise, measured vertically, in any main floor or in any gallery or in any balcony without a direct exit by tunnel or otherwise, to a corridor with free opening onto the gallery stairs or other direct discharge to the street or at any such elevation of eleven feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than four feet wide in the clear.

(b) There shall be no openings in tne foyer wall between the foyer and theatre proper other than the exit openings.

616. **Main Floor—Balcony and Gallery—Designation of.)** (a) The lower floor of every theatre shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

617. **Width of Aisles—Exit from Aisles—Steps in Aisles.)** (a) The minimum width of aisles with divergent sides in any room used for the purpose of Class V shall be two feet eight inches at the end nearest the stage and not less than three feet at the other end. The minimum width of aisles with parallel sides shall be three feet.

(b) Every aisle shall lead directly to an exit. An exit located at the end of any aisle and at right angles thereto shall be considered a direct exit.

(c) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than eight inches in height, and no tread shall be less than ten inches in width, and wherever the rise from bank to bank of seats is less than five inches, the floor of the aisle shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated but shall be grouped together, and a light shall be installed so that every place where there are steps in such aisles or corridors shall be clearly lighted.

618. **Corridors — Passageways — Hallways and Doors—Width of—Leading from Toilet Rooms and Cloak Rooms to Outer Exits of the Building—Width of Entrance Doors.)** (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, provided, however, that no corridor shall be less than five feet in width and no doorway less than three feet wide, except as otherwise herein provided.

(b) Every toilet room, retiring room, smoking room, cloak room, check room or private office which is accessible from any corridor, passageway, hallway or stairway leading from any floor, balcony or gallery shall, in addition to the entrance thereto, have an exit arranged in such manner as to permit of direct passage through such room or office, without returning, to an outer exit of the building. Corridors, passageways, hallways and stairways shall be at least four feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

(c) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each 100 permanent seats in the audience room, and in addition thereto a proportionate part of twenty inches for the fraction part of 100 seats remaining shall be added.

619. **Emergency Exits and Stairs—Width of—Emergency Stairs—Construction of, Requirements—Shall Not be Obstructed—Emergency Exits Inside Walls of Buildings—Doors to Open Outward.)** (a) Emergency exits and stairways shall be provided separately for each floor, balcony or gallery and shall be of the same aggregate width as that provided for the main exits, and shall be not less than three feet in width. Such emergency stairway shall be made of iron, steel or other incombustible material.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

(c) If such emergency exits lead outside the building, the openings leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall, and outer shutters shall not be permitted.

(d) Whenever such emergency stairway passes above an exit door, window or other opening, such stairway shall be completely enclosed by iron, steel or other incombustible material for a space of five feet greater in width than such opening, and such openings below such emergency stairway shall be equipped with approved metal frames and doors or metal sash and wired glass.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or obstructions of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street, without entering into or passing through or over any buildings unless by a four-foot wide fireproof passage on the court or ground level.

(g) All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward.

620. **Proscenium Wall Curtain and Requirements — Permit for and Inspection of Curtain.)** (a) There shall be a solid masonry wall of the same construction and thickness as is required in the outside walls of the building in which such theatre is located between the auditorium and the stage.

(b) The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such proscenium opening. The curtain shall be raised and lowered by hydraulic power, and shall be in constant use as the regular curtain and act drop.

(c) The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be from the stage level and the other shall be designated by the Commissioner of Buildings.

(d) The curtain shall have a steel covering on the outer or auditorium side. The stage side covering shall be of a non-heat-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees Fahrenheit on the stage side for fifteen minutes without heating the opposite side to a higher temperature than three hundred and fifty degrees Fahrenheit.

(e) All metal work with the exception of the frame shall be covered with such non-heat-conducting substances on the stage side.

(f) The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channel or in the engaging edge of the curtain shall be less than three-eighths of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

(g) The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship, shall be according to the best modern engineering practice. The stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

(h) No part of a curtain or of the curtain guides shall be supported by or fastened by any combustible material.

(i) The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist either inward or outward a pressure of five pounds for each and every square foot of the curtain.

(j) No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

(k) Plans for every such curtain shall be approved by the Commissioner of Buildings and a permit obtained therefor previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, and for each such inspection a fee of five dollars shall be charged.

(l) Every other opening in such proscenium wall shall have self-closing regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

621. **Stage—Construction of—Framing for Scenery.)** The framing for the floor of every stage shall be of iron, steel or reinforced concrete. The stage floor may be of wood not less than two and three-quarters inches thick, provided the underside of stage floor shall be saturated with a fireproof solution satisfactory to the Chief of Fire Prevention and Public Safety. The entire floor construction and the floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and permanent cables and their supports shall be of iron, steel or reinforced concrete. All framing for scenery and all stage paraphernalia shall be saturated with a fireproof solution the same as prescribed for stage flooring.

622. **Vestibules for Stage Doors.)** All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

623. **Structures Over Ceiling—Construction.)** If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall be fireproofed in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

624. **Vents—Size of—Flue Pipes—Dampers—Switches for Dampers.)** (a) One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional story.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof materials, with an air space between, and no fuses shall be exposed to the air between the switchboards.

625. **Standpipes—Automatic Sprinklers—Tanks for Water.)** (a) A system of standpipes and of automatic sprinklers subject to the approval of the Chief of Fire Prevention and Public Safety, shall be provided and installed in every theatre.

(b) The supports and installation of all tanks used to supply water to such system of standpipes and such automatic sprinkler system shall be subject to the approval of the Commissioner of Buildings.

626. **Ice Making Machinery—Prohibition of.)** It shall be unlawful to install any machinery or compressors of any description to be used in conjunction with ammonia in the manufacture of artificial ice in the auditorium or stage parts of any building of Class V, and it shall be unlawful to convey ammonia or to install any piping for the conveying of ammonia into any building of Class V for the purpose of manufacturing artificial ice from any machinery or compressors situated outside of any building of Class V.

627. **Lighting Service Requirements**—Gas or electricity or both may be used for illuminating purposes in buildings of Class V hereafter erected. Gas shall not be used in that part of the building known as the stage side of the proscenium wall. Provisions shall be made to properly light every portion of a building of this class and every outlet therefrom leading to the outside of the building and all open courts, passageways and emergency exits. Lights in vestibules, halls, corridors, passageways, stairways and other means of egress from the building and premises shall be on an independent circuit or service and shall be controlled

separately and exclusively by a switch or shutoff located near the main entrance. In rooms, halls and auditoriums used for the purposes of this class, provisions shall be made to furnish a light supplied by gas and a light supplied by electricity above if possible, otherwise closely adjoining every opening to an exit or to an emergency exit from the room, hall or auditorium.

628. **Dressing Room Partitions.)** Partitions forming dressing rooms shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated as in the judgment of the Commissioner of Health may be required.

629. **Capacity—Certificate for License.)** (a) The Commissioner of Buildings shall determine the number of persons which each room used for the purpose of Class V may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) Before a license shall be issued for the operation of a buiding of Class V as a theatre the Commissioner of Buildings shall first certify, in writing, that such theatre complies with the provisions of this chapter in every respect.

630. **Scenery—Definition—Movable Scenery.)** (a) "Scenery" as used in this chapter shall include all scenery, drop curtains, borders and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

(b) "Movable Scenery" shall include all scenery, drop curtains, borders, and wings which are made movable for the purpose of changing an entire set of scenery and substituting another set during or between the various stage acts.

631. **Changing from Class IV to Class V.)** Whenever an existing Class IV theatre is changed into a Class V theatre, the same shall be made to comply with all of the provisions for Class V theatres hereafter erected.

ARTICLE IX.

Class VI.

632. **Class VI Defined.)** In Class VI shall be included every tenement and apartment house or building or portion thereof, which is used or intended to be used as a home or residence for two or more families living in separate apartments.

633. **Requirements—General.)** Every building of Class VI shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

634. **Definition of "New Tenement House"—"Apartment"—"Yard"—"Court"—"Shaft" "Public Hall'"—"Stair Hall"—"Basement"—"Cellar"—"Story"—"Solid Masonry".)** (a) "New tenement house" shall include every tenement, flat and apartment house erected after December 17, 1902 and every tenement house which shall hereafter be increased or diminished in size or otherwise altered after its erection and every building now or hereafter in existence not now used as a tenement house but hereafter converted or altered to such use. "Existing tenement house" shall be construed to mean a flat or apartment house built prior to December 17, 1902.

(b) "Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

(c) "Yard" is an open unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

(d) "Court" is an open, unoccupied, unobstructed space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court"; a court bounded on one side and both ends by a tenement house, and on the remaining side by a lot line is a "lot line court"; a court extending to a street, alley or yard is an "outer court."

(e) "Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bath room, or pantry.

(f) "Public Hall" is a hall, corridor or passageway not within an apartment.

(g) "Stair Hall" includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

(h) "Basement" is a story partly, but not more than one-half below the level of the inside sidewalk grade of the street nearest the building. If the floor of such basement is less than two feet (2 ft.) below such grade or if the ceiling of such basement is more than seven feet, six inches (7 ft. 6 in.) above said grade, said story shall be classed as the first story of the building in which it occurs. Provided, however, that the ceiling height may be raised above the height of seven feet, six inches (7 ft. 6 in.) heretofore given, not more than one-third of an inch for every foot of such distance said building

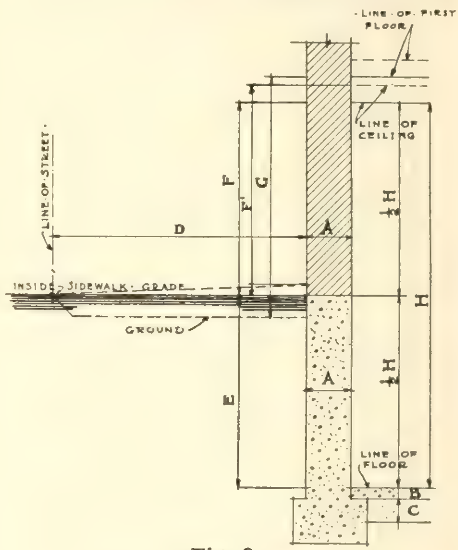


Fig. 9.

DEFINITION OF BASEMENT, ETC.
Sec. 634

(H) Height of basement (floor to ceiling).
(D) Distance from street line nearest the building.
(E) Distance below sidewalk grade.
(F) Distance above sidewalk grade.

Explanation:

Basement is a story partly but not more than ½ below (½ H) the level of the inside sidewalk grade. If floor of basement is less than 2 ft. (E) below such grade, or if ceiling of such basement is more than 7′ 6″ (F) above said grade, said story shall be classed as first story.

(F) For every foot of (D) F may be raised not more than 1-3″, as at (F′).

(G) Equals distance from ground to line of first floor.

Ex. for yard ground levels or walks or other improvements for a distance of 12′ 0″ at every point from all outside walls. (G) shall not be lower than 8′ 3″.

Sec. 659

(A) Not to be less than 12″. (See Sec. 506 for exceptions).
(B) 3″ thickness of floor required.
(C) 6″ sand or cinders required.

is set back from the street line of the street nearest the building, but in no case shall any rise of ceiling be allowed for any distance beyond thirty feet (30 ft.) said building may be set back from the line of the street nearest the building, and in such cases all rises in the basement ceiling shall be computed according to the distance between the street line and the outside wall of the building nearest to said street line. Provided further, that the yard or ground level, or walks, or other improvements thereon for a distance of twelve feet (12 ft.) at every point from all outside walls of said building shall not be lower than eight feet three inches (8 ft. 3 in.) below the floor level of the first story of said building.

(i) "Cellar" is a story more than one-half below the level of the inside sidewalk grade of the street nearest the building.

Where the grade of a street adjacent to a tenement house varies, the average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this chapter.

(j) "Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

635. **Where Sections of This Article Conflict With Other Sections.)** In cases of direct conflict with the provisions of other sections of this ordinance relating to other classes, or of sections in other articles of this chapter, the provisions of the sections in this article relating to Class VI shall govern in respect to tenement houses.

636. **Changes or Alterations—Permits.)** Every new tenement house and every change or alteration in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Commissioner of Buildings. Such permit shall be issued only upon an application by the person, firm or corporation for whom the building is to be erected or altered, and after approval of the plans and specifications for such tenement house or for such changes or alterations by the Commissioner of Health whenever such approval is required by the ordinances of the City of Chicago.

637. **New Tenement House—When to be Occupied.)** (a) No new tenement house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the Commissioner of Health that said building conforms to the requirements of this chapter relative to light and ventilation, plumbing and drainage applicable to said buildings, nor until the issuance by the Commissioner of Buildings of a certificate that the said building conforms to the requirements of this chapter relative to fire escapes and means of egress applicable to new tenement houses. Within five days from date of application for any certificate above mentioned, such certificate shall be issued or the official concerned shall state in writing his reasons for his refusal to issue said certificate.

(b) The certificate above referred to may be issued in the case of a new tenement building comprising more than three apartments so as to allow the occupation of any section of the building extending from cellar to roof in advance of the completion of the other portions of the building.

(c) When the outer walls of a new tenement house have been erected so as to outline the position of the courts and shafts required for the lighting and ventilation of habitable rooms, the owner of the building or his representatives shall be entitled, upon application in writing, to an inspection of the same by the Commissioner of Buildings, and if the work to that point is in compliance with the provisions regarding the size of shafts and the location of the building, to a certificate setting forth those facts.

(d) When the work of constructing partitions has advanced to a degree on any floor, that the rooms on that floor are determined in their dimensions, the owner or his representatives shall be entitled to an inspection from the Commissioner of Buildings, and if the rooms thus outlined conform in their dimensions to the plans filed and to the requirements of this chapter, he shall be entitled to a certificaet stating that fact.

(e) If a new tenement house is occupied as a place of habitation in any of its parts in violation of this section, it shall forthwith be subject to notice from the Commissioner of Buildings and shall be vacated upon such notice and shall not again be occupied until made to conform with the provisions of this chapter nor until after the issuance of the two certificates required in this section.

638. **Plat to be Filed.)** At the time of applying for a permit for the erection of, alteration of, addition to or moving of a tenement house or for the erection, alteration, adding to or moving of any building upon a lot upon which a tenement house stands, the applicant shall submit to the Commissioner of Buildings a plat of the lot, showing the dimensions of the same and the position to be occupied by the proposed building or by the building to be altered or added to or by the building to be moved thereon, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

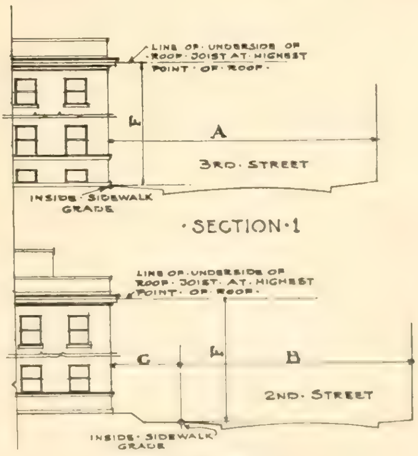
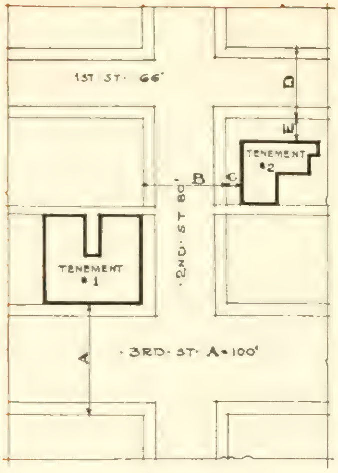


Fig. 10.

639. **Corner Lot Defined—Frontages.)** By "corner lot" is meant a lot situated at the junction of two streets or of a street and a public alley at least sixteen feet wide, provided that if such alley be less than sixteen feet wide, and the lot be estimated on a line sixteen feet from the opposite side of the alley, such lot may be considered a corner lot. Any portion of the width of such lot distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots. Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone, and not alley frontage shall be considered in determining such lesser frontage.



·PLAN·

Fig. 11.

SECTION 640 a b.

Height of Tenement House; How Measured.

A—width of widest street (in this case 3rd St.) on which tenement house No. 1 abuts.

B—width of widest street (in this case 2nd St.) on which tenement house No. 2 abuts.

C—distance tenement house No. 2 sets back from 2nd St.

D—width of 1st St., other street on which tenement house No. 2 abuts.

E—distance tenement house No. 2 sets back from 1st St.

F—allowable height, which in this illustration is measured as shown by the perpendicular distance from the inside sidewalk grade of the street nearest the building, to the highest point of the external bearing walls. For exceptions, where elevator enclosures and cornices or bulkheads are used, see section 640 b, last paragraph.

Explanation:

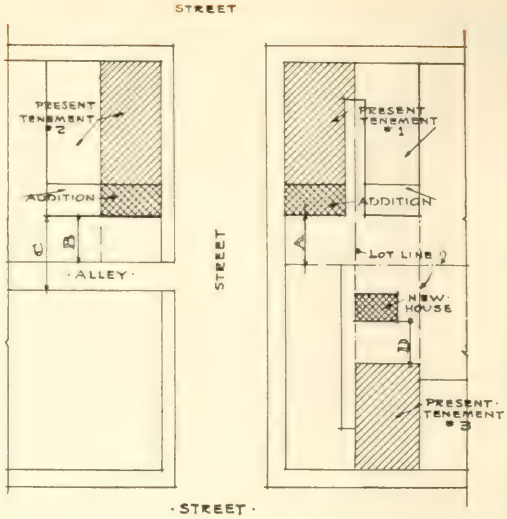
F—tenement house No. 1 shall not exceed 1½ A.

F—tenement house No. 2 shall not exceed 1½ (B+C) unless 1½ (D+E) is greater than 1½ (B+C), then F shall not exceed 1½ (D+E).

640. **Height—How Measured.)** (a) The height of a new tenement house shall not exceed by more than one-half the platted width of the widest street on which it abuts, and no existing tenement house shall be increased beyond such height.

(b) Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation. Such height shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the external bearing walls and shall not include any cornice or bulkhead less than eight feet high or any elevator enclosure less than sixteen feet high. Where such street grade varies, the mean or average grade thereof opposite such building shall be the data from which such height is measured.

641 **Distance Between Buildings.)** No existing tenement house shall hereafter be enlarged or its lot be diminished, so that the rear line of any building on such lot approaches nearer than ten feet to the rear line of the lot, unless the rear of the lot upon which it stands, abuts upon a public alley, in which case the rear line of such building shall be not less than sixteen feet from the opposite side of such alley. Where a tenement house, now existing or hereafter erected, stands upon a lot other than a cor-



·PLAN·

Fig. 12.

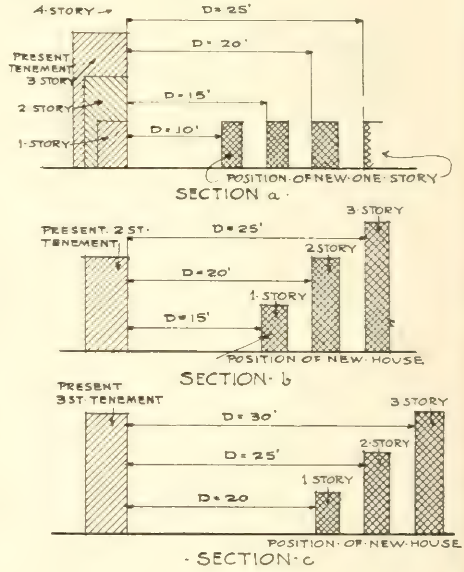


Fig. 13.

SECTION 641

A—distance from rear line of addition, to present tenement house No. 1, to rear line of lot.

B—distance from rear line of addition, to present tenement house No. 2, to rear line of lot, abutting public alley.

C—distance from rear line of addition, to present tenement house No. 2, to opposite side of such alley.

D—distance from present tenement house No. 3, standing on an inner lot, to new building.

Explanation:

A shall not be less than 10 ft. either by addition to, or diminishing present tenement house No. 1.

If B is less than 10 ft., then C must not be less than 16 ft. Sections a, b, c, are explanatory diagrams of different cases of required distances D, between tenement house No. 3 and new house. Exception to this rule is stated in last paragraph of Section 641.

ner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, if neither building exceeds the height of one story; or fifteen feet, if either building exceeds the height of one story, but not the height of two stories, and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one, in the height of the highest building on such lot; Provided, that a one-story building without basement, and not used for habitation, may be placed on the rear of a lot containing a tenement house, if a minimum distance of ten feet is maintained between every point of such building and the tenement house.

642. **Percentage of Area Allowed to be Covered.)** No existing tenement house shall hereafter be enlarged nor its lot be diminished, nor other buildings be placed on its lot, nor a tenement house be moved on a lot on which there is an existing building, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings, than the following proportions, respectively: No new tenement house alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot, provided that in the case of a fireproof building, in which the windows of every habitable room open directly on a street, the portion of the lot covered may be ninety per centum of the area of said lot, subject to the requirement that a ten foot space must be left above the first story opposite the lesser frontage; or more than ninety per centum of the area of such corner lot if such corner lot is bounded on at least three sides by streets or alleys; or more than seventy-five per centum of the area of any other lot, except that the space occupied by fire escapes, constructed and erected according to law and not more than four feet wide, shall be deemed unoccupied. Provided, however, that in case of a lot, triangular or irregular in shape bounded on two or more sides by a street and having a number of lineal feet street frontage exceeding one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot which may be covered.

643. **Must Have Alley or Yard in Rear—Size of Yard Increased.)** At the rear of every lot containing a tenement house, there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law, unless the rear of such lot abuts upon a public alley at least ten feet wide, in which case the rear line of such building shall be not less than 16 feet from the opposite side of such alley; every part of such yard shall be directly accessible from every other part thereof; such yard shall have an area of at least eight per centum of the superficial area of the lot on corner lots except as otherwise provided in this section; and on other lots, such yards shall have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial area of the lot for every story above three stories in height of the tenement house situated thereon.

644. **Courts — Inner — Outer — Lot Line.)** (a) "Inner courts" of all new tenement houses as defined in Section 634 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Courts— Height of	Least width in feet.	Least area in square feet.
1 story	6	100
2 stories	6	120
3 stories	8	160
4 stories	8	160
5 stories	12	260
6 stories	16	400
7 stories	20	625
8 stories or more	24	840

(b) The height of a court shall be the number of stories having habitable rooms with windows in its walls.

(c) "Outer courts" and "lot line courts" of all new tenement houses as defined in Section 634 of this chapter shall have minimum widths at every point equal to one-half of the minimum widths required by this section, and lot line courts shall have minimum areas equal to one-half of the minimum areas required herein for "inner courts." If an outer court or lot line court has windows on opposite sides, its minimum width shall conform to the width given in the table.

(d) The minimum widths hereinbefore specified for outer courts and the minimum widths and areas specified for lot line courts are to be provided irrespective of the presence of or dimensions of courts on other premises bounded by the same lot line.

(e) Every "inner court" and every "lot line court" of every new tenement shall be connected directly with a street, alley, yard, or outer court by an opening extending from grade at the building to a height of at least fifteen feet, and kept unobstructed save by an openwork grill or gate, such opening to be at least two feet wide for an inner court and one foot wide for a lot line court. In case of a three-story tenement on a lot twenty-five feet or less in width, a continuous lot line passage open to the sky, **and six inches in width**, shall be accepted for the opening specified above as one foot wide for a lot line court. If such inner court or lot line court starts from any point above finished grade at building, such starting point shall be considered as grade for purpose of determining the location of the opening to outer air herein specified.

(f) In case of a three-story tenement on a lot of twenty-five feet or less in width a continuous lot line passage open to the sky, and at least three feet wide, shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a). In case of a three-story tenement on a lot thirty feet or less but more than 25 feet in width, a continuous lot line passage open to the sky, and at least three feet six inches wide shall be acceptd in lieu of a lot line court or outer court hereinbefore specified in Paragarph (a).

(g) In case of a two-story tenement on a lot twenty-five feet or less in width, a lot line court having an area of at least fifty square feet shall be accepted in lieu of a lot line court heretofore specified in Paragraph (a) of this section, and in case of a three-story tenement on a lot of twenty-five feet or less in width, a lot line court having an area of at least sixty square feet shall be accepted in lieu of a lot line court hereinbefore specified and required by Paragraph (a) of this section.

(h) In case of two or three-story tenement buildings on lots twenty-five feet or less in width, where there is only one apartment on each story containing not more than four rooms in such apartment, the light courts hereinbefore specified in Paragraph (a) may be omitted, provided there is a continuous passageway open to the sky and not less than three feet wide on one side of said building.

645. **Vent Shafts—Area Of.)** (a) "Vent shafts" of all new tenement houses, as de-

fined in Section 644 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Height of Vent shafts	Least width in feet	Least area in square feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 stories or more	8	120

(b) Every such vent shaft in every new tenement house more than two stories high, shall be connected directly with a street, alley, yard or court by one or more horizontal ducts or intakes at a level not lower than the finished grade of building nor higher than second story floor; the total area of such ducts to be not less than three per cent of the area of such vent shaft, and no single duct to be of less area than one hundred square inches; such total and individual duct area shall be net over and above all obstructions.

646. **Stair Hall and Shaft—Well-Hole Dimensions.)** (a) Every public stair hall in every new tenement house shall, for each story, have a window of an area of at least twelve square feet, opening directly on a street, alley, yard or court; or on a shaft of minimum area, as hereinafter provided; or shall have an unobstructed vertical well-hole of the following minimum area at each floor line above the first, and, directly over such well-hole, there shall be a skylight of twice the following minimum area:

Building—Height of	Least area in square feet of stair shaft or well hole.
2 stories—if there is more than one apartment on a floor	8
3 stories—if there is more than one apartment on a floor	13
4 stories	19
5 stories	25
6 stories or more	38

(b) Such window, if any, shall be so placed that light may pass directly to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance. In any such public hall, recesses or returns, the length of which does not exceed twice the width of the hall, will be permitted, without an additional window, but, otherwise, each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

(c) Skylights shall be ventilating skylights and shall have over them a wire netting mounted on wire frame and 6-inch iron legs, of wire not lighter than No. 12 and with mesh not coarser than one inch by one inch, unless constructed of wired glass or prismatic light glass.

647. **Rooms—Size and Height Of—Attic Rooms.)** (a) In every new tenement house, all habitable rooms shall be of the following minimum sizes:

(b) In each apartment, there shall be at least one room containing not less than one hundred twenty square feet of floor area, and every other room shall contain at least eighty square feet of floor area, provided, however, that in the case of a room having a window not less than eighteen feet in area opening upon a public street, the floor area need not be greater than seventy feet. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling; provided, however, an attic room need be eight feet six inches high in but one-half of its area, in case there are not less than 750 cubic feet of air space therein.

648. **Alcoves and Alcove Rooms.)** (a) For the purpose of buildings of Classes III and IV, an alcove shall be defined as a recess connected with or at the side of a larger room. The floor of such an alcove shall be counted as a part of the floor area and its cubic contents as a part of the cubic contents of the room with which it is connected.

(b) In every new tenement house every alcove shall be deemed a separate room for all purposes within the meaning of this chapter, except an alcove that has a floor area of not to exceed thirty-five square feet and that has an unobstructed opening, equal in area to twenty per centum of its entire wall surface, into an adjoining habitable room; provided that in constructing additional habitable rooms by raising or altering existing one story dwellings, the limitation of the floor area of an alcove may be disregarded, provided such alcove has an unobstructed opening, equal to the floor area of such alcove, into an adjoining habitable room.

(c) This section shall not be construed as forbidding the erection of pilasters or other decorative effects projecting not more than eighteen inches from the plane of the wall of a habitable room.

(d) No part of any room in a tenement house shall be enclosed or sub-divided at any time, wholly or in part, by a curtain, portiere, fixed or movable partition or other contrivances or device, unless each part of the room so enclosed or sub-divided shall contain a separate window as herein required, and shall have a floor area of not less than 80 square feet as herein required for habitable rooms, except as heretofore provided in this section.

649. **Air—Quantity of for Each Person.)** No room in any tenement house shall be occupied so that the allowance of air to each adult person living or sleeping in such room shall at any time be less than four hundred cubic feet or less than two hundred cubic feet for each person under twelve years of age.

650. **Habitable Rooms — Bath Rooms — Pantries—Requirement as to Ventilation and Lighting.)** (a) In every new tenement house every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area opening onto a street, alley, yard or court. None of such required windows shall have a glass area of less than ten square feet, and each such window shall have its top not less than even feet above the floor and shall be so constructed that at least its upper half may be opened its full width.

(b) In every new tenement house every bath room, water closet, or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of one foot, opening upon a street, alley, yard, court or vent shaft.

(c) In every new tenement house every pantry shall have at least one window of not less than six square feet in area, with a width of not less than one foot, opening into a street, alley, yard, court or vent shaft, which vent shaft shall be at least six square feet in area.

(See Illustration Sec. 47-B.)

651. **New Tenements — Habitable Rooms in Basements—Prohibited in Cellars.)** In no new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room

in the basement of a new tenement house shall be constructed, altered, converted or occupied for living purposes unless such rooms shall be at least eight feet six inches high in the clear and shall have at least one-half of such height above the finished grade of said premises at the building, and at least four feet three inches of such height above the average street grade at the building. Provided that only (1) living apartment not exceeding six (6) rooms shall be allowed in the basement of any tenement house hereafter to be constructed.

652. **Tenement Houses—Requirements for Fireproof and Slow-burning Construction.)** Every new tenement house more than five stories and basement high shall be of fireproof construction. Every new tenement house more than three stories and basement high, but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required, the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

653. **Frame Tenement — Requirements.)** In every new frame tenement house outside the fire limits, each suite of apartments shall be separated from the next suite in such building by a partition of four-inch tile or of metal studding and metal lath, and the enclosing walls around the stairs, where there are two or more apartments on a floor, shall be of fireproof construction or of solid masonry of the same dimensions as are required by Section 732.

654. **Frame Additions to Frame Tenement Houses Within Fire Limits Not Permitted—removal of Frame Tenement Houses.)** No frame addition shall be permitted to any frame tenement house within the fire limits, either by adding to its height or its superficial area.

If a tenement house, standing on wooden supports, is moved to another lot, it shall not again be placed on wooden supports, but shall be placed on a masonry or concrete foundation.

If a frame tenement house, not more than two stories high, is moved from one location to another upon the same lot, it may be set upon wooden posts and a basement or cellar not to exceed six feet six inches in height from the floor to the ceiling thereof may be maintained thereunder, and no habitable rooms shall be constructed or occupied in said basement or cellar.

655. **Entrance Halls—Solid Masonry—Exceptions—Ceilings.)** Every main entrance hall in a new tenement house shall be at least three feet six inches wide in the clear from the entrance up to and including the stair enclosure and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there be only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the following sections of this ordinance as to the construction of stair halls. If such main entrance hall is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs, respectively, shall be increased respectively at least one foot in width for each additional flight of stairs.

656. **Stair Halls—Construction Of.)** (a) The stairs and stair halls in all new tenement houses more than three stories and basement or cellar high shall be constructed of incombustible material throughout, except that the treads of stairs may be of wood not less than one and three-eighths inches thick and all handrails may be of hardwood.

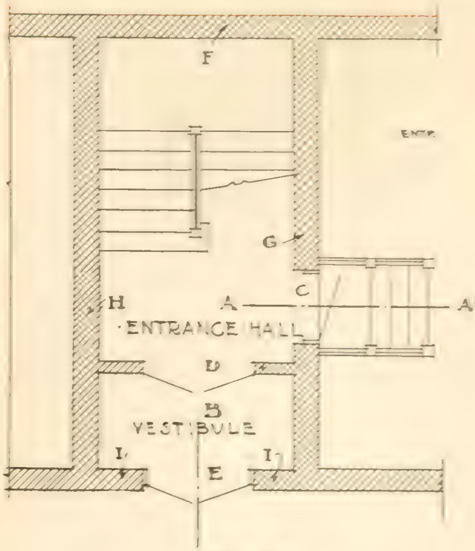
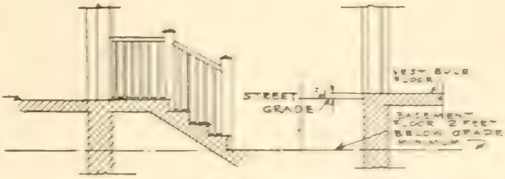


Fig. 14.



·SECTION·A·A · SECTION B·B·

Fig. 15.

SECTION 656 B [illegible]

[illegible] ...ule, etc.

If walls [illegible] I, [illegible] fireproof construction, and door C [illegible]

[illegible]

(b) In every new non-fireproof tenement house all stair halls shall be enclosed on all sides with walls of solid masonry of the dimensions required by Section 732. All windows in stair halls, except where same open into a street, alley, outer court, or yard, shall have metal frames and sashes, glazed with wired glass. This section shall not apply to tenement houses which are not more than three stories and basement high with only one apartment on each floor. Where the main entrance vestibule and entrance hall [illegible] fireproof const[illegible] ter, from the [illegible] same, without changing the definition of the word "Basement" with regard to height of floors, as contained in Section 634.

([illegible])

657. **Apartments Divided by Masonry.)** (a) There shall be a wall of solid masonry of thickness as required by Section 732 extending from the ground to the roof between each set of apartments and around each court and each light shaft, except as hereinafter provided; (1) provided, however, that a wall between apartments and extending from the main stair hall to the outer wall of the building may be offset at the second story floor line to some point nearer the center of the building, or of the group of apartments, to admit of an even distribution of space in the rooms adjacent to such wall, if such wall is supported at the second story floor line on fireproofed steel or iron beams which extend from the brick wall surrounding the main stair hall to the outer wall of the building; and provided, further, that such offset wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry walls as above specified; (2) and provided, that, in case there is a store or stores in the first story of a building of this class, a masonry dividing wall between apartments may begin at the second story floor line, if such dividing wall is supported on fireproofed steel or iron beams carried by masonry; and provided, further, that such dividing wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry. In buildings of fireproof construction the partitions between apartments, and around stairs may be of burnt clay tile not less than three inches in thickness or reinforced concrete partitions not less than three inches in thickness.

(b) In buildings of ordinary construction two separate thicknesses of metal lath and fire-resisting plaster shall be used as fireproofing as required by this section.

658. **Ceiling Over Stores — Courts and Shafts Beginning Above First Story.)** (a) In every new non-fireproof tenement house in which there is a store or stores in the first story, if the building is three stories or less in height, the portions of the first story ceiling directly under all public halls shall be of slow-burning construction, and if the building is four or more stories in height the entire basement and first story construction and the second story floor construction shall be of fireproof construction.

(b) In every new non-fireproof tenement house the masonry walls enclosing every court or light or vent shaft beginning above the first story shall be supported on fireproofed steel or iron beams carried by masonry or by fireproofed steel or iron columns; and such court or shaft enclosing walls may be reduced to the thickness of eight inches if supported at every intersecting floor line on fireproofed steel or iron beams carried as above specified.

659. **Damp-Proofing—Basement Wall to Be Masonry—Cement Floor.)** In every new tenement house constructed of brick or frame, the foundations and basement walls shall be built of masonry or concrete not less than twelve inches in thickness, except as provided in Section 732 and shall have all outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other approved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar. The basement or cellar of every existing and new tenement house shall have a floor of Portland cement concrete not less than three inches in thickness laid on not less than six inches of sand or cinders.

(See Illustration Sec. [illegible].)

660. **Bay Windows—Courts—Vent Shafts.)** (a) The walls of every bay window and every court in masonry constructed new tenement houses shall be built of brick or other fireproof construction as required for exterior walls.

(b) The walls of every interior vent shaft in masonry constructed tenement houses shall be built of masonry or of fireproof material not less than four inches in thickness, supported by steel or iron.

661. **Porches.)** (a) Where porches are constructed in courts of now existing or new tenement houses, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No additional rear porch shall be constructed on any existing tenement house in such way that the buildings on the lot with all their porches shall occupy a greater proportion of the lot than is permitted in Section 642 of this chapter. No rear porch on any existing tenement house where the total area of buildings and all porches exceeds the proportion of the lot permitted in Section 642 of this chapter shall be reconstructed until the plan for such re-construction shall have been submitted to and approved by the Commissioner of Buildings. No rear porch built of combustible materials and more than eight feet in width, excepting stairways, shall be constructed on any new tenement house nor added to, nor reconstructed on any existing tenement house.

(b) Front porches of buildings in existence at the time of the passage of this ordinance may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided that the glass area shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half of their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and the area of such open sash shall be at least twice the area of all windows from adjacent rooms opening on to porches so enclosed, unless such room adjoining said porch shall have windows opening on to a street, alley, yard or court of proper legal dimensions as required by this chapter, for habitable rooms in addition to the windows opening on to the porch, in which case the amount of movable sash in porch enclosure shall be not less than ten per cent of the floor area of said porch and in no case less than ten square feet of glass area.

(c) Rear porches and side porches of buildings in existence at the time of the passage of this ordinance, where every part of said porch is at least ten feet distant from any other building, porch or structure located upon the same lot with the building of which such porch is a part, may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided, that the glass area of the enclosure shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and in no case shall be less than three times the area of all windows, doors and transoms opening on to said porch, and that in every case the top of the sash in such enclosure shall be at least six inches higher than the top of the windows and doors opening on to such porch. The framing of the porch enclosure may be of wood, and the glass area of each side and each end of such porch shall be not less than fifty per cent of the entire side or end of such porch enclosure

measured from the floor of the porch to the under side of joists immediately above such porch in each story.

(d) In every building erected after the passage of this ordinance, every front porch, rear porch or side porch which is intended to be enclosed must have enclosing walls as required by the ordinances of the city for enclosing walls of a building of the type of which said porch is a part, and every porch so enclosed shall be considered a separate habitable room and shall comply with all the requirements of this chapter for habitable rooms, and such porch enclosure shall not in any manner intercept the light or the ventilation of any adjoining room.

(e) Where buildings do not exceed three stories in height the stairways in rear porches may be partially enclosed as follows; the end of the porch outside the stairway, also the back of the porch around said stairway not to exceed eleven feet in extent, may be enclosed with wood or frame construction and a window with glass area of nine square feet shall be placed in the back enclosure or in that part of the porch facing the yard or court on each story.

662. **Flues and Chimneys.)** In every building used for the purposes of Class VI, the flues or chimneys shall conform to the following regulations: For one stove opening, the flue area shall be not less than forty-nine square inches. For more than one stove opening and one furnace opening, the flue area shall be not less than seventy-seven square inches. All such flues shall be constructed according to the requirements of Section 800 of this chapter.

663. **Bulkhead in Roof—Construction of —When Required.)** There shall be in the roof of every new tenement house, unless the pitch of the roof thereof exceeds one foot rise in four foot run, at least one bulkhead or scuttle, fireproof or covered with fireproof material, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. Where such tenement house is provided with rear stairs, there shall be a bulkhead or scuttle accessible from each of such rear stairs. No scuttle or bulkhead door shall have any lock on it but may be fastened on the inside by movable bolts or hooks.

664. **Stairways—Width and Construction of.)** (a) Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story, and which stairs shall be as far apart as practicable. One of said stairways shall be an interior stairway. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs without going through any other apartment. An apartment whose gross floor area does not exceed 1,000 square feet and having not to exceed six habitable rooms in an existing tenement house and which at the time of the passage of this ordinance had not access to two stairways, may have exit to a second stairway through another apartment, providing the door between the two apartments is equipped with a glass panel not less than five feet high and twenty inches wide, with the bottom of same not less than eighteen inches above the floor. Or where the floor level of said apartment is not more than twelve feet above the surface of the yard or ground surrounding the building, a balcony with an area not less than eighteen square feet equipped with a drop ladder to the ground may be attached to the outside wall of said building accessible by a door or window from such apartment. Such glass panel, door or balcony and ladder, as the case may be, shall be considered as a secondary means of exit from said apartment, if in the judgment of the Commissioner of Buildings such glass panel door, balcony and ladder will afford safe means of exit for any such apartment. Where halls or stairs in an existing tenement house have been damaged by fire or otherwise to an extent greater than one-half the value thereof, such halls or stairs so damaged shall be repaired so as to conform to the requirements of this chapter with regard to halls and stairways relating to new tenement houses.

(b) All enclosed stairs in every tenement house shall have at least one handrail, and where the width of such stairs is greater than 3 feet 6 inches, such stairs shall have a handrail on each side thereof. All open stairs shall be provided with suitable and substantial handrails on each side.

(See Illustration Sec. 613).

665. **Stairs in Non-Fireproof Buildings, Eighty or More Rooms.)** Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in this chapter.

666. **Stairs in Fireproof Buildings, One Hundred and Twenty Rooms and Upward.)** Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building may be made at least one-half wider than is provided in this chapter.

667. **Stairs—Entrance to — Treads and Risers.)** Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

(See Illustration Sec. 613).

668. **Fire Escapes.)** Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by this chapter. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access, without passing through any other apartment, to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then such apartment shall have direct access to a stairway fire escape. Every court in which there is a fire escape shall have direct and unobstructed access along the surface of the ground to a street or alley or to yard opening into an alley or street without entering into or passing through or over any building unless by a four foot wide fireproof passage on the court or ground level. Except as herein specifically provided, the

number, location, material and construction of fire escapes shall be controlled by the general provisions of this chapter on fire escapes.

669. **Shafts, Courts, Yards, Graded—Drained.)** In every now existing and new tenement house, the bottom of all shafts, courts or yards shall be provided with sanitary drainage and shall be graded or paved.

670. **Access to Rooms—Otherwise than Through Bedroom.)** In each apartment in every new tenement house, access to every living room and bedroom, and to at least one water closet compartment shall be had without passing through any bedroom.

671. **Water Closets—Window in—Artificial Light.)** (a) In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, except that where there are apartments consisting of only one or two rooms, in which case there shall be at least one water closet for every two apartments.

(b) Every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a vent shaft of at least one-half the minimum area required in Section 645. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass panels or transoms.

672. **Sinks — Requirements.)** In every new tenement house there shall be in each apartment at least one kitchen sink with running water. In every existing tenement if there be not one such sink in each apartment there shall be on every floor at least one kitchen sink with running water, accessible to all the tenants of the floor, without passing through any other apartment. In no tenement house shall there be woodwork inclosing sinks; the space underneath sinks shall be left entirely open.

673. **Pipes Through Floors—Catch Basins—Water Closets.)** (a) In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

(b) In the premises of a tenement house the catchbasin shall, whenever practicable, be placed in a court or yard, and shall be covered with a stone or iron cover, flush with the surface so that access to such basin shall be convenient.

(c) Where it is for any reason impracticable to place a catchbasin in a court or yard, the Commissioner of Health may authorize the use of an iron catchbasin with air-tight cover, located in the cellar or basement.

674. **Buildings Damaged by Fire, Etc.)** If any existing tenement house is hereafter damaged by fire or other cause, including ordinary wear, so that at any time its value be less than one-half its original value exclusive of the value of the foundations, such building shall not be repaired or rebuilt except in conformity with the provisions of this ordinance applicable to new tenement houses.

675. **Provisions of this Article Not to Apply to Existing Buildings, Except Under Certain Circumstances—Then Commissioner to Notify.)** (a) Nothing in this Article contained shall be construed as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this Article and which at the time of their construction were built in compliance with the ordinances then in force, unless they are in conflict with the requirements of Section 649, 668, 669, 672, 677, 678, and 679 or unless such buildings shall not have sufficient or adequate means of egress therefrom, by reason of insufficient or inadequate stairways, improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

(b) Where it shall appear to the Commissioner of Buildings that any such building has insufficient means of egress therefrom as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building, as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

676. **Rooms and Halls — Additional.)** Every room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this ordinance as to size, arrangement, light and ventilation of rooms and halls.

677. **Rooms — Change in Existing.)** No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a window having a superficial area not less than one-twelfth of the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet and a minimum width of not less than two feet six inches, or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, between which two adjoining rooms there shall be an alcove opening equal in extent to at least 20 per cent of the entire wall surface of said room, provided, however, that all of the requirements of Sections 641 and 642 shall be complied with.

Where a frame tenement house is moved from one lot to another, or from one location to another on the same lot, it shall comply with the provisions of Section 654 of this Chapter.

(See Illustration Sec. 470 B).

678. **Windows—Courts—Attic.)** No room in any now existing tenement house, which has no such window as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least seven feet six inches distant from every part of the finished floor thereof; provided, that an attic room need be seven feet six inches high in but one-half of its area, and, provided, further, that such attic room has not less than seven hundred fifty cubic feet of air space therein; and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

(See Illustration Sec. 470 B).

679. **Existing Tenements—Living Rooms in Cellars or Basements—When Permitted.)** (a) In every existing tenement house, no room in an existing cellar or basement shall be occupied for living purposes unless such room shall be at least seven feet six inches high in the clear, and have not more than four feet eight inches of such cellar or basement below the finished grade at building; provided that no such room shall be

used for living purposes unless such room shall have a window opening upon a street, alley, yard or court, and, provided, that when the windows of any living room front solely upon a street and the floor of such basement is four feet eight inches below the sidewalk grade, such windows shall be located not less than three feet back of the lot line; provided, however, that in every case where the height of ceiling of any living room is less than eight feet six inches in the clear, the window area of such room shall be at least 15 per centum of the floor area.

(b) When a brick or frame tenement house is moved from one lot to another, or from one location to another on the same lot and a basement or story, or both, is constructed under the same, the total height of which is more than six feet six inches from the floor to the ceiling, the walls of such basement shall be constructed of masonry according to the provisions of Section 872, and the habitable rooms therein shall comply with the provisions of Section 677, and the space on the lot shall comply with the provisions of Section 641 and Section 642.

680. **Insanitary Conditions — Nuisance.)** A tenement house or part thereof which is in an insanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water or by reason of the presence of sewer gas, or by reason of any portion of such building being infected with disease, or being unfit for human habitation, or which by reason of any other insanitary condition is a source of producing sickness among the inhabitants of this city, or which in any way endangers the public health, is hereby declared to constitute a public nuisance.

ARTICLE X.

Class VII.

681. **Class VII Defined.)** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

682. **Must Comply With General and Special Provisions.)** Every building of Class VII shall comply with the general provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

683. **Buildings of Class VII—Construction of.)** Buildings three stories or less in height, used either wholly or in part for the purpose of Class VII, may be of ordinary construction. Such buildings more than three and not exceeding five stories in height shall be of slow-burning mill or fireproof construction. Such buildings over five stories in height shall be of fireproof construction.

684. **Stores Used for Retail Sale of Goods or Manufacturing Purposes—Occupation of Basement—Lockers.)** (a) Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for locker provisions in excess of accommodations for the number of employes on the floor on which they are employed, or for manufacturing purposes in a building devoted wholly or in part to purposes of Class VII except as hereinafter provided; provided, however, the stories above the twelfth story may be used for these or other purposes when equipped with an approved automatic sprinkler system approved by the Chief of Fire Prevention and Public Safety; and provided further, that all such buildings hereafter erected to be used for these purposes, or so used, above the twelfth story shall in addition to being equipped with an approved automatic sprinkling system have enclosed stairways.

(b) Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the floor nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade: Provided, however, that in all existing buildings of fireproof construction having a floor not more than thirty-two feet below the inside street grade, and having a partial intermediate floor or gallery between such floor and the level of the inside street grade, with an opening through such intermediate floor not less than forty feet by forty feet in area, and having direct exits on such floor and intermediate floor or gallery connecting on substantially the same levels with the floors of adjacent buildings of fireproof construction, the retail sale of goods shall be permitted on such floors not more than thirty-two feet below the inside street grade if such floors shall be properly and thoroughly ventilated and mechanically supplied with not less than two thousand cubic feet of air per hour for each twenty square feet of floor area, exclusive of walls, stairs and elevators, and if such buildings are equipped throughout and on such floors below the inside street grade with an automatic sprinkler system approved by the Chief of Fire Prevention and Public Safety, and if the number and character of stairways and emergency exits comply with the provisions of this chapter applicable to buildings of Class VII of fireproof construction; and further provided, that in addition to the foregoing requirements there shall be at least one fireproof stairway enclosed in a fireproof tower extending from such sub-basement to the first floor of such building with no openings into said tower except from the sub-basement and first floor.

(c) Except as above provided in paragraph (b) of this section in relation to existing buildings, no sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the first floor, inclosed in fireproof partitions. Such stairs from such locker or dressing rooms shall be, in addition to other stairways required by this chapter for such buildings, and at least one of such stairways shall open directly on a street, alley or court opening on a street or alley, or on a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room, such lockers shall be of incombustible material.

(d) Where stories above the twelfth story are used for the purposes of Class VII as hereinbefore described for locker provisions in excess of accommodations for employes on the floor on which they are employed, then the stairways from the first to the topmost floor shall be built and inclosed as described in Section 880, but the stairways shall be in number and aggregate width as required in the table for stairways set forth in Section 878 of this chapter.

685. **Floor Areas—Maximum.)** (a) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of ordinary construction shall not exceed nine thousand square feet.

(b) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

(c) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of fireproof construction shall

not exceed 25,000 square feet, unless the building is completely equipped with an approved automatic sprinkler system, but in no case shall such area exceed 30,000 square feet.

686. **Floor Areas—Exceeding the Maximum Limits Defined in Section 685.)** (a) Where any floor or portion of a floor used for the purposes of Class VII in any building shall exceed in area the maximum number of square feet allowed in the preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls, or dividing walls built in accordance with the provisions of Section 463 of this chapter relating to dividing walls in buildings of Class I.

(b) Where any such floor so used is divided by such fire walls or dividing walls, each such division of such floor shall be provided with stairs, aisles, exits, and fire escapes as required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate building, except as provided in Section 712 of this chapter.

687. **Galleries.)** (a) The area of any or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII in any building shall not exceed ten per centum of the area of such story. Galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

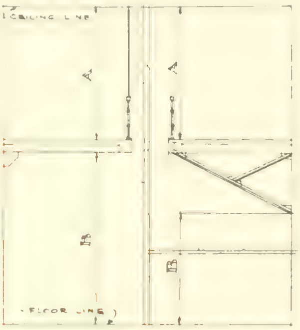


Fig. 16.

SECTION 687 C.

A—height from floor of any gallery, mezzanine or intermediate floor to ceiling over same.

B—space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, etc., is placed.

Explanation:

A—shall not be less than 7′0″.

B—shall not be less than 7′0″.

(b) Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

(c) The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than seven feet, and there shall be not less than seven feet of space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

(d) Every gallery, mezzanine or intermediate floor in any building used for the purposes of Class VII shall be built to conform to the construction applicable to such building, but galleries not exceeding five per centum of the area of such story, may be built of incombustible material without fireproof protection.

(e) No gallery, mezzanine or intermediate floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, mezzanine or intermediate floor shall be filed with the Department of Buildings when a permit is applied for.

688. **Courts of Class VII Buildings.)** (a) Every court or light shaft of every building used wholly or in part for the purposes of Class VII shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portions thereon of wired glass.

689. **Stories—Numbering of.)** The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered consecutively, the second, third, and so on.

690. **Stairs — Halls — Passageways and Aisles—Signs and Lights.)** (a) The stair halls, passageways and stair aisles shall be unobstructed and be as wide as the stair and not less than four feet wide in the clear.

(b) The exit door or doors between floors and stair halls shall be not less than ninety per centum of the width of the stairway to which they afford access, and for each elevator opening into such a stair hall, the doors to floors shall be increased six inches in width.

(c) The stairways and stair halls of any building used wholly or in part for the purpose of Class VII shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

(d) At the bottom of each such stairway there shall be an illuminated red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

691. **Exit Signs and Lights.)** (a) All exits in buildings used wholly or in part for the purposes of Class VII shall be clearly indicated by illuminated red signs with the word "Exit" thereon in letters not less than six inches high. At the bottom of each stairway on the street floor level there shall be similar signs indicating the direction of the nearest exit to a street or alley.

(b) Fire escape doors or windows shall be indicated by illuminated red signs with the words "Fire Escape" thereon in letters not less than six inches high.

692. **Doors at Street Level—Revolving Doors.)** The clear width of the exit openings shall be computed in the same manner as that provided in this article for main aisles, and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

693. **Doors in Dividing Walls.)** (a) Door openings may be built in dividing walls of such buildings; provided, however, that such door openings shall be not less than five feet in width and shall be provided with fireproof doors built as described in Section 789 of this chapter, and that each door shall have an efficient closing device which will operate automatically in the event of a fire in close proximity to either side of such door.

(b) Each such opening shall have exit signs and lights as provided for street doors and exits in Section 691 of this chapter.

694. **Loads—Allowance for Live Loads in Construction of Floors of Buildings of Class VII.)** For all buildings of Class VII the floor shall be designed and constructed in such a manner as to be capable of supporting, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors, and shall be figured in accordance with Section 729 of this chapter.

ARTICLE XI.

Class VIII.

695. **Class VIII Defined—Provisions of.)** In Class VIII shall be included every building used for school purposes and every building containing class rooms for special or general instruction, other than halls for the purpose of instruction as included in Class IV, where such building so used shall have a seating capacity of more than fifty students.

696. **Must Comply With General and Special Provisions.)** All buildings of Class VIII shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to such general provisions shall comply with the following special provisions:

697. **Construction of.)** (a) All buildings hereafter erected and used or intended to be used wholly for the purposes of Class VIII shall be constructed in accordance with the provisions of this chapter relating to Class VIII; and existing school buildings shall comply with the provisions of Class VIII with reference to stairs, exits and fire escapes.

(b) Buildings which have a seating capacity of two hundred or less and which are not over two stories and basement in height, may be built of ordinary construction; provided, that no portion of such building shall be used for assembly hall purposes.

(c) Buildings which have a greater seating capacity than two hundred and not exceeding four hundred, and which are not over three stories and basement in height, shall be built of slow-burning or fireproof construction.

(d) Buildings which have a greater seating capacity than four hundred, or which are more than three stories and basement in height, shall be built entirely of fireproof construction.

(e) Additions to existing buildings shall be built of the several types of construction required by this section; provided, however, that the sum total of the seating capacity of the entire building, including additions, shall be counted in determining the type of construction required for such addition.

(f) All alterations in existing buildings used for the purposes of Class VIII, other than new additions thereto, and intended to make them comply with the requirements of this chapter, may be executed in the same kinds of materials originally used in such buildings, unless otherwise distinctly provided herein.

698. **Walls—Window Openings in.)** No wall of any building used for the purposes of Class VIII and containing a window opening shall be nearer than five feet to any lot line of adjoining property, street and alley lines not included.

699. **Portable Frame Buildings.)** Portable frame buildings used wholly for the purposes of Class VIII, not larger than 28 by 36 feet and not over one story high, may be erected, provided exterior walls and roof of same are covered with metal or other incombustible material, and the interior woodwork painted with fire-retarding paint approved by the Commissioner of Buildings; and, provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the original permit.

700. **Assembly Halls—Limitations as to Seating Capacity and Floor Level.)** (a) The limit of height at floor level and the maximum seating capacity of assembly halls or auditoriums or other single rooms in buildings of this Class must not exceed the numbers given in the following table, for the specified type of construction, to-wit:

Floor—Height of Above Grade.	Type of Construction: Fireproof Construction.	Slow burning or Mill Construction Having Fireproof Stairs and Corridors.	Ordinary Construction.
	Persons.	Persons.	Persons.
Over 60 ft.....	500	100	...
60 ft. or less..	600	300	...
45 ft. or less..	700	500	...
30 ft. or less..	1000	800	250
20 ft or less..	1500	900	500
10 ft. or less..	2000	1000	800
5 ft. or less..	2500	1200	1000

(b) All assembly halls or other single rooms having a seating capacity larger than that given in the above table must have the highest part of the main floor within not more than one foot of grade level and must have exits leading directly to three streets, public alleys, or to open public grounds.

(c) Seating capacity of all assembly halls in buildings of this Class shall include the total aggregate seating capacity of all balconies, galleries, stages and platforms as well as the main portion of such assembly hall or rooms.

(d) Heights of assembly hall floors shall be measured from sidewalk level at entrance of building or open school grounds to highest part of main floor of such assembly hall or rooms.

701. **Stairways — Width of.)** (a) Stairways in buildings used for the purposes of Class VIII shall be equivalent in width to fifteen inches for every hundred of seating capacity in such building as measured by the aggregate seating capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

(b) No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet in width in the clear may be counted in the total width of stairs required.

(c) Where two or more stairways are used, they shall be placed at opposite ends of the building or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one sliding or stairway fire escape.

(d) All stairways in buildings of Class VIII shall have hand railings on each side thereof. No stairway shall ascend a greater height than thirteen feet six inches without a level landing, the dimensions of which, in the direction of the run of the stairs, shall not be less than four feet, or which, if at a turn of the stairs, shall be of not less width than the width of the stairs. No winder shall be permitted in any stairs. Stairways which are over nine feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high at each stair landing. All stairways shall discharge at the bottom directly to a public thoroughfare or open ground.

(See Illustration Sec. 613).

702. **Stairways in Buildings Hereafter Erected—Fireproof.)** In buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing walls shall be of fireproof construction.

703. **Width of Corridors, Passageways, Hallways and Doorways.)** The width of corridors, passageways, hallways and doorways shall be equivalent in width to eighteen inches for every one hundred of seating capacity of such portions of building as will be required to use same for exit. No corridor, passageway or hallway shall be less than five feet in width, and no doorway less than three feet in width, except where two or more doors, each two feet eight inches or more in width, are grouped together.

704. **Doors to Open Outward—Covering of.)** All doors in such buildings shall open outward. All exit doors from assembly halls to other parts of the building shall be covered with metal or other fireproof material approved by the Commissioner of Buildings.

705. **Aisles—Width of—In Assembly Halls and in Recitation and Study Rooms.)** (a) Aisles in assembly halls in buildings of Class VIII shall be equivalent in width to eighteen inches for every one hundred seating capacity in such assembly hall, but no such aisles shall be less than two feet six inches in its narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

(b) Aisles in class rooms, recitation rooms and study rooms of such buildings shall be equivalent in width to eighteen inches for every one hundred permanent seats in any such room, but no aisle shall be less than sixteen inches in width and no main or cross aisle be less than two feet six inches in width.

706. **Emergency Exits for Assembly Rooms—Aggregate Width of.)** All assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with at least two emergency exits. The aggregate width of such emergency exits, which shall be provided for each floor, balcony or gallery of such assembly hall, shall be not less than nine inches in width for every one hundred of seating capacity or portion thereof. No emergency exit or stairway shall be less than three feet in width. Emergency exits must be located as far apart and as far from main exits as practicable, subject to the approval of the Commissioner of Buildings.

707. **Lights in Buildings—Window—Skylights.)** (a) Provisions shall be made to properly light every portion of any such building devoted to the uses or accommodations of the public and all outlets therefrom leading to the street, including the open courts and corridors, stairways and exits, during the entire time such building is in use.

(b) All gas or electric lights in the class rooms of main building and in halls, corridors, lobbies, stairs and exits leading from the assembly halls shall be independent of lights in assembly hall. By "independent" shall be construed a separate pipe from meter or separate circuits from switchboard.

(c) The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-fifth of the floor area of such room.

(d) Class rooms, recitation rooms and study rooms that have exterior windows on one side only must have the top of glass in such windows at a height above the floor of such room of not less than one-half of the distance to the opposite parallel wall or partition.

(e) Such rooms having exterior windows on two opposite sides of the room shall have the top of glass in such windows not less than one-fourth the distance between walls in which the windows are placed. The height of windows in corner rooms having windows in adjacent walls shall be computed from nearest wall or partition to opposite window.

(f) Where skylights or skylights and windows of sufficient size to give the proper glass area are used these heights of windows shall not be required.

708. **Scenery—Sliding Curtains—Screens.)** No curtains or scenery shall be used in any assembly hall, except only, that it shall be permissible to use a pair of sliding curtains hung on horizontal metal rods not over twelve feet above the floor of stage and portable screens set on the floor and not over eight feet high. Provided, however, in assembly halls located on the first floor or ground floor of a fireproof building, it shall be permissible to use curtains hung from the ceiling or top of proscenium opening.

709. **Moving Picture Machines.)** Moving picture machines may be installed and used in assembly halls located on the first floor or ground floor of fireproof buildings of Class VIII. When moving picture machines are so used they shall be located in booths constructed of fireproof materials with metal clad doors and a vent duct to the outside air having a cross sectional area of at least 100 square inches.

710. **Basement When Used for Class Rooms.)** (a) In every such building in which the lower or basement floor is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such floor shall be considered the basement story of such building.

(b) Class rooms, recitation rooms or study rooms shall not be allowed in basements less than twelve feet in height in the clear nor where the floor is more than two feet below the level of the sidewalk at nearest entrance of building nor in basements which are not properly lighted by windows or skylights as defined elsewhere in this Chapter for such rooms.

711. **Stories—Height of.)** No story above the basement shall be less than twelve feet in height in the clear.

712. **Fire Escapes.)** (a) Every building used for the purposes of Class VIII of three

or more stories in height shall be provided and equipped with stairway fire escapes or sliding fire escapes as herein provided.

(b) All such buildings having a seating capacity of less than two hundred on any one floor above the second floor shall have at least one such fire escape.

(c) All such buildings having a seating capacity of over two hundred but less than four hundred in any one story above the second floor shall have at least two such fire escapes.

(d) All such buildings having a seating capacity of more than four hundred but less than six hundred on any floor above the second floor shall have at least three such fire escapes.

(e) At least one additional stairway or sliding fire escape shall be provided for every increase of two hundred seating capacity in any one story above the second floor.

(f) Stairway fire escapes shall be built in accordance with the requirements of Sections 881, 882 and 885, and shall be subject to the approval of the Commissioner of Buildings.

(g) Sliding fire escapes shall be securely anchored or fastened to the building and shall have a radius or width of not less than thirty-six inches, and the inner side of the same shall be entirely smooth and made of metal. There shall be an entrance to each sliding fire escape from each floor above the first story. They shall be of a pitch of not less than thirty degrees nor more than forty-five degrees for straight runs. They shall be so constructed that they will discharge people not more than twenty-four inches from the adjacent ground or floor. They shall be of such pattern and design as will best secure the safety of the public, and their construction, location and maintenance shall be subject to the approval of the Commissioner of Buildings. Spiral sliding fire escapes shall have two complete turns for each story height of more than thirteen or less than sixteen feet.

(h) All the provisions of this Chapter relating to outside sliding or stair fire escapes shall apply to buildings of Class VIII, unless such buildings are fireproof, in which case interior fire escapes from ground to roof may be substituted for exterior fire escapes, provided such interior fire escapes shall comply with each and all of the following conditions:

(i) Interior fire escapes in fireproof buildings shall be enclosed in brick or concrete walls on all sides from top to bottom, and shall be enclosed at the top with a fireproof penthouse. The treads and risers of such interior fire escapes shall be the same as those used for stairs elsewhere in the building and the width of such fire escapes shall not be less than forty inches in their narrowest part between hand rails.

(j) The landings of such fire escapes shall, exclusive of and in addition to the space covered or occupied by swinging doors, be at least equal to the stairs in width. All doors leading to such fire escapes shall be incombustible doors and the glass portion thereof shall be glazed with polished wired glass not less than one-quarter of an inch thick, which shall be large enough to enable persons to see other persons on the opposite side of the door. The combined width of said doors on each landing shall exceed the stair width twenty-five per cent, but no single door shall be more than three feet wide. They shall be hinged and equipped with automatic opening and closing devices and shall open outward. Windows lighting such fire escapes shall have metal frames and sash and wired glass.

(k) The number and capacity of such interior fire escapes shall in no case be less than is elsewhere in this Chapter required for outside fire escapes, and the locations of the same shall be as far apart as practicable and so placed as to best secure the safety of the persons using the same in case of fire, accident or panic.

(l) Such interior fire escapes which comply with all the conditions above enumerated may be used daily as ordinary stairs.

713. **The Commissioner of Buildings, the Chief of Fire Prevention and Public Safety, Commissioner of Gas and Electricity, and Superintendent of Police Shall Close Buildings for Violations.)** The Commissioner of Buildings, the Chief of Fire Prevention and Public Safety, Commissioner of Gas and Electricity, and Superintendent of Police, or any of them, shall have the power to close or order closed any building used wholly or in part for the purposes of Class VIII wherein there is any violation of any ordinance which it is their duty to enforce, and to keep the same closed until such provisions are complied with.

ARTICLE XII

Class IX.

714. **Class IX Defined.)** In Class IX shall be included every building maintained by the City of Chicago for police station purposes.

715. **Requirements General.)** Every building of Class IX shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to the general provisions shall comply with the following special provisions:

716. **Construction.)** (a) All buildings of Class IX not more than two stories and basement in height may be of ordinary mill, slow-burning or fireproof construction.

(b) All buildings of Class IX more than three stories and basement high shall be built of fireproof construction.

All buildings of Class IX containing a court room or court rooms above the second story shall be built of fireproof construction.

All buildings of Class IX three stories and basement or less in height which do not contain a court room or court rooms above the second story may be built of ordinary construction excepting that part of the building containing the cell room or lockup and the patrol wagon quarters, or either of them, which part shall be built of fireproof construction and shall be separated from all other parts of the same building by a wall of the same character and thickness as is required by this chapter for the outside walls of such building and where necessary by a fireproof floor and ceiling of the same thickness as the brick walls by which said floor and ceiling is supported.

(c) Buildings erected for or converted to the use of police stations for temporary purposes may be of mill or slow-burning construction not more than ninety feet in height from the average inside sidewalk grade of the street in front of the building to the highest part of the roof of the building.

717. **Allowance for Live Loads and Construction of Floors of Class IX.)** The floors of all buildings of Class IX shall be designed and constructed as follows:

In all buildings of Class IX the floors of all court rooms, and of all public corridors, and of all stairways leading to same, shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and all other floors, or parts thereof, shall be designated and constructed so as to be capable of carrying

a live load of fifty pounds for every square foot of floor surface, and such floor-bearing capacity shall be computed in accordance with this chapter.

718. **Windows.)** (a) In every building of Class IX every room, including court rooms, public and private offices, shall have at least one window opening directly upon a street, alley, yard or court; the total glass area of such window or windows shall not be less than one-tenth of the floor area of such room. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened. Such window shall have a glass area of at least ten square feet unless it be a window in excess of one-tenth of the floor area as required by this paragraph. Cell blocks shall have at least three outside walls of same to face upon a street, alley, yard or court and where windows are placed in the three sides with a total glass area equal to one-fourth of the floor area of such block and each window is arranged so that it may be opened for one-half of its area, it shall not be required that each cell open onto a street, alley, yard or court. No sleeping rooms or cell rooms shall be allowed below the first floor level in any building of Class IX.

(b) In every building of Class IX every pantry, bath room, water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such windows shall be not less than one-tenth of the floor area of such room or compartment. The top of such windows shall be at least seven feet above the floor and at least the upper half of such windows shall be capable of being opened; and no such windows shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located on the upper story of such building, may be lighted and ventilated by means of a skylight having a glass area of at least one-tenth the floor area of the room it serves and is equipped with an efficient ventilator or ventilators equal in effective area to one twentieth the floor area of such room.

719. **Courts and Shafts.)** In every building of Class IX courts shall be of the minimum width and area as prescribed in Section 644 of this chapter and vent shafts shall be of the minimum width and area as prescribed in Section 645 of this chapter.

720. **Height of Rooms.)** In every building of Class IX the height of all rooms except basement rooms shall be not less than ten feet from the level of the floor to the ceiling thereof, and the height of court rooms, if any, shall not be less than eleven feet from the level of the floor to the ceiling thereof.

721. **Thickness of Walls.)** The walls of every building of Class IX shall comply in thickness with the requirements of Section 732 of this chapter as therein prescribed for buildings of Class I.

722. **Stairways and Fire Escapes.)** Every building of Class IX shall be equipped with stairways and fire escapes in number and dimensions as follows:

In buildings of ordinary, slow-burning or mill construction which do not contain a court room or court rooms and with a floor area of 5,000 square feet or less, two stairways.

With floor area of 5,000 to 9,000 square feet, three stairways.

In buildings of ordinary, slow-burning or mill construction which contain court rooms and with a floor area of less than 5,000 square feet, two stairways and one stairway fire escape.

With floor area of 5,000 to 9,000 square feet, three stairways and one stairway fire escape.

In buildings of fireproof construction with a floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

All buildings of Class IV over four stories in height must be equipped with stairway fire escapes as follows:

With a floor area of 7,000 square feet or less, one stairway fire escape, three feet in width.

With a floor area of 7,000 to 21,000 square feet, two stairway fire escapes not less than three feet in width.

No stairways in buildings of Class IX shall be less than four feet in width between hand rails.

In buildings less than three stories high and in buildings three stories high which may be built of ordinary construction by the provisions of this article, stairways may be of ordinary construction enclosed in brick walls of thickness as required by paragraph (h), Sec. 732 of this chapter, or stairways may be of fireproof or incombustible material enclosed in partitions of fireproof or incombustible material.

723. **Exits from Court Rooms.)** (a) There shall be two direct exits located as far apart as practicable from every court room in a building of this class; the width of such exits shall be computed on a basis of twenty inches for each 100 persons of the aggregate capacity of such court room, and for fractional parts of 100 capacity, a proportionate part of twenty inches shall be added to the width of such exits, but no such exists shall be less than three feet wide in the clear. One of such exits shall open onto a public corridor not less than six feet wide from which there is a stairway leading to the ground at least four feet wide in the clear between hand rails. Where there is but one stairway from such public corridor an additional exit from each court room must be afforded by a stairway at least four feet wide in the clear between hand rails or by means of an outside iron stairway not less than three feet wide; the platform of which shall be placed approximately level with the floor of the court room and accessible by a door not less than three feet in width.

724. **Doors to Open Outward.)** In buildings of Class IX all doors which afford ingress or egress from all rooms, except private offices, shall open outward.

ARTICLE XIII.

General Provisions.

725. **Construction or Alteration of Building — Requirements.)** Every building or structure or part thereof, hereafter constructed, erected, altered, enlarged, repaired or changed within the City shall be so constructed, erected, altered, enlarged, repaired or changed, in accordance with the provisions of this Chapter.

726. **Class of Buildings Not to Be changed Without Conforming to Provisions of This Chapter.)** If buildings, the uses of which bring them within any of the classes mentioned in this Chapter, are to be applied to the uses of any other class for which a better system of construction is required by this Chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this Chapter as specified for their intended use. And it shall be unlawful to use any such building for a new or different purpose from that to which its structure and equipment adapts it under this Chapter, unless a permit for

such alterations or use shall have been first obtained from the Commissioner of Buildings and the requirements of this chapter for such new or different use shall have been complied with.

727. **Alterations of Existing Buildings.)** (a) In construing the several sections of this Chapter, said sections shall not be construed as requiring alterations in the construction or equipment of buildings or structures in existence at the time of the passage of this Chapter, except where specifically provided, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto, by reason of insufficient or inadequate stairways or stairways improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress and except also as required in sections which are herein made retroactive.

(b) Whenever an Inspector of Buildings shall make a report to the Commissioner of Buildings that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, the Commissioner of Buildings shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to make such building comply with the requirements of this Chapter.

(c) If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make a change in its use or occupation which will transfer it from one class as recognized by this Chapter to another class, then, before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, written notice shall be given to the Commissioner of Buildings of the intention to change the character of the use, and the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into compliance with the provisions of this Chapter.

728. **Removal of Brick, Stone, Frame or Concrete Buildings.)** It shall be unlawful for any person, firm or corporation to move any brick, stone, frame or concrete building from one location to another, unless the same shall be altered or re-constructed so as to conform to the ordinances governing the construction of such building at the time of moving the same and in its new location; provided, however, that whenever a tenement house is moved, the same shall be made to comply with the requirements of Section 677 and Section 679.

729. **Live and Dead Loads—Wind Resistance.)** (a) The "dead load" shall include all permanent portions of the building, also partitions and permanent fixtures and mechanisms supported by the building. The "live load" shall include all movable loads or weights placed on floors or other parts of buildings.

(b) All buildings shall be designed to resist a horizontal wind pressure of 20 lbs. per square foot for every square foot of exposed surface. In no case shall the overturning moment due to wind pressure exceed seventy-five per cent of the moment of stability of the building due to the dead load only.

(c) The "live" loads to be provided per square foot of floor areas, except stairs, for the classes of buildings except portions of Classes VIII and IX as herein otherwise provided shall be not less than the following:

	Pounds.
Class I	100
Class II	50
Class III	40
Class IV	100
Class V	100
Class VI	40
Class VII	100
Class VIII	75
Class IX	100

(d) Provided, however, that in Class VIII the portions of the building exclusive of the floors in assembly halls, the corridors and the stairs, shall not be required to be constructed to support a live load in excess of 40 pounds per square foot.

(e) The roofs of all buildings shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering, of at least twenty-five pounds for each square foot of horizontal surface.

(f) The live loads to be provided for on stairways for buildings of all classes shall not be less than 100 pounds per square foot of treads and landings.

730. **Structural Details—Strength Tests—How Made.)** (a) All structural details and workmanship shall be in accordance with accepted engineering practice, and subject to the approval of the Commissioner of Buildings.

(b) Floors, joists and beams shall be designed for the full dead and live loads. Floor girders shall be designed for the full dead and not less than eighty-five per cent of the live load.

(c) In buildings of every class except Class III and frame buildings, intermediate supports for joists shall be either brick, concrete, iron or steel columns, beams, trusses or girders.

(d) If brick walls are used for this purpose, they may, in all cases where the thickness of walls is given, in Section 732, as 16 inches or more, be made four inches less in thickness than the dimensions stated.

(e) Tests shall be made by the owner, upon the demand of the Commissioner of Buildings, on all forms of floor construction involving spans over eight feet. Such tests shall be made to meet the approval of the Commissioner of Buildings, and must show that the construction will sustain a load equal to twice the sum of the live and dead loads, for which it was designed, without any indication of failure. The construction may be considered as part of the test load. Each test load shall remain in place at least twenty-four hours. On arch construction, this test load shall be placed on one-half of the arch, covering the area from the support to the crown of the arch.

731. **Walls, Piers and Columns—Dead and Live Loads.)** (a) The full live load on roofs of all buildings shall be taken on walls, piers, and columns.

(b) The walls, piers and columns of all buildings shall be designed to carry the full dead loads and not less than the proportion of the live loads given on next page.

(c) The proportion of the live load on walls, piers, and columns on buildings more than seventeen stories in height shall be taken in same ratio given at top of next page.

(d) The entire dead load and the percentage of live load on basement columns, piers and walls shall be taken in determining the stress in foundations.

(e) In addition to the entire dead loads not less than the following proportion of the percentage of live load on the basement columns, piers and walls shall be taken in

Floor	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
17	85 per cent.																
16	80	85															
15	75	80	85														
14	70	75	80	85													
13	65	70	75	80	85												
12	60	65	70	75	80	85											
11	55	60	65	70	75	80	85										
10	50	55	60	65	70	75	80	85									
9	50	50	55	60	65	70	75	80	85								
8	50	50	50	55	60	65	70	75	80	85							
7	50	50	50	50	55	60	65	70	75	80	85						
6	50	50	50	50	50	55	60	65	70	75	80	85					
5	50	50	50	50	50	50	55	60	65	70	75	80	85				
4	50	50	50	50	50	50	50	55	60	65	70	75	80	85			
3	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85		
2	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85	
1	50	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85

determining the number of piles for pile foundations and the area of concrete caissons.

Classes I and VII......... 75 per cent.
Classes II, III and VI..... 50 per cent.
Classes IV, V and VIII.... 25 per cent.

In all foundations eccentric loading must be provided for.

[illegible] **Requirements for Enclosing Walls—Table of Thickness — Exceptions — Definition of the Length of Wall—Buttresses, Piers or Pilasters — Inserting Columns in Walls — Anchorage of Walls and Floors—Definition and Limits for Height of Stories — Curtain Walls—Interior Walls to Support Fireproof Floor Construction.)** (a) The walls of all buildings, excepting the enclosing walls of frame buildings, shall be of brick, stone or concrete. The walls shall be solid and of solid material and except as otherwise herein provided shall be of the thickness in inches indicated in the following table:

	Basement.	Stories 1	2	3	4	5	6	7	8	9	10	11	12
One-story	12												
Two-story	16	12	12										
Three-story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	[illegible]	28	28	28	24	24	24	20	20	20	16	16	16

(b) In Class VIII buildings the thickness of surrounding walls and of all dividing walls carrying loads of floors and roof shall be as indicated in the following table:

	Basement. in.	Stories 1 in.	2 in.	3 in.	4 in.	5 in.
One story	16	12				
Two stories	16	16	12			
Three stories	16	16	16	12		
Four stories	20	20	16	16	12	
Five stories	24	20	20	16	16	16

(c) In Class VIII buildings, walls around stairs, elevators and air shafts and joist supports shall comply with the requirements of Section 855 of this Chapter.

(d) The basement walls of two-story buildings and the first story walls of three-story buildings in Classes III and VI may be twelve inches in thickness. The first story walls of one-story buildings and the second story walls of two-story buildings in Classes III and VI may be eight inches in thickness, provided that where a pressed brick face is used no wall shall be less than twelve inches in thickness, and an eight-inch brick or solid concrete partition wall may be built in a building of any class, but in no case shall any eight-inch brick wall be more than fourteen feet in height.

(e) The basement walls of two-story buildings in Classes II, III and VI may be 12 inches in thickness.

(f) In buildings of skeleton fireproof construction, the thickness of walls shall be governed by Section 837 of this Chapter.

(g) Walls less than fifty feet in length and walls less than fifty feet between cross walls, may be built four inches less in thickness than the thickness given in the aforesaid table, but no such wall in such buildings shall be less than twelve inches in thickness, provided, however, that such walls in buildings of Classes III and VI may be sixty-five feet in length; and further provided, that eight-inch walls may be used in one-story brick buildings and in the second story of two-story brick buildings of said last mentioned classes where said eight-inch walls are not more than fourteen feet in height and are supported by a foundation or wall not less than twelve inches in thickness.

(h) A brick wall not more than twenty-five feet long and forming one side of a brick shaft for stair, elevator or other purposes, need not exceed sixteen inches in thickness, nor its upper fifty feet twelve inches in thickness, provided that in no case shall the load on such brick wall exceed the safe load for brickwork prescribed by this ordinance.

(i) The length of a wall shall be the distance in which the wall extends in a straight line and shall be measured between angles of the masonry or between exterior and cross walls.

(See illustration on following page.)

(j) Where masonry buttresses or piers or pilasters are employed on either or both sides of a wall, then said walls may be reduced in thickness by one-half of the projection or projections of the buttresses or piers or pilasters, but no wall shall be reduced to less than twelve inches in thickness. The reduction in thickness may be made throughout the height of the wall, except that no twelve-inch wall shall be higher than thirty feet and no sixteen-inch wall shall be higher than fifty feet. The stress

in the brickwork in any part of such walls shall not exceed the stress per square inch allowed by this chapter on the kind of masonry employed. Buttresses or piers or pilasters shall be at least one-tenth as wide, measured on face of same, as the spacing between the buttresses or pilasters. Twelve-inch walls between buttresses or piers or pilasters shall not be used where the distance between buttresses or piers or pilasters is greater than eighteen feet. Sixteen-inch walls shall not be used between buttresses or piers or pilasters where the distance between buttresses or piers or pilasters is greater than twenty-four feet. Twenty-inch walls shall not be used between buttresses or piers or pilasters where the distance between the buttresses or piers or pilasters is greater than thirty feet.

(k) Where buttresses are used, they shall be so placed that the principal girders and trusses shall bear on them.

(l) If the loads carried by trusses and girders are supported by iron, steel, or reinforced concrete columns, then such buttresses as are herein described shall not be required except for the fireproofing of steel and iron columns. The walls between such tems or between such structural floor systems and structural roof systems and shall be as follows:

Where 12-inch walls are used, the story height shall not exceed 18 feet.

Where 16-inch walls are used, the story height shall not exceed 24 feet.

Where 20-inch walls are used, the story height shall not exceed 30 feet.

(o) Where the story height is greater than thirty feet, the walls shall not be of less thickness than the following: The upper fifteen feet shall be not less than sixteen inches in thickness, and the walls shall be increased four inches in thickness at each interval of fifteen feet or fractional part thereof of height.

(p) Curtain walls in skeleton construction buildings may be built of hollow clay tile subject to the requirements and limitations of paragraph (c), Section 779 of this chapter, or may be constructed of reinforced concrete subject to the provisions and limitations of Section 766 of this chapter.

(q) The walls of buildings to be used for the purposes of Classes III and VI and

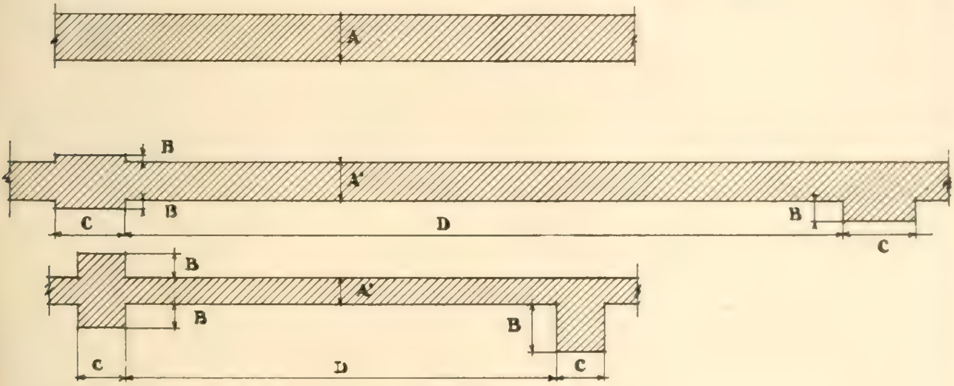


Fig. 17.

THICKNESS OF WALLS. Section 732j.

A = thickness of wall.
A′ = thickness of wall after reduction.
B = projection of buttresses, piers or pilasters.
C = width of buttresses, piers or pilasters.

Explanation:
A may be reduced by ½ B as at A′.
C = 1-10 D.

columns shall be built as required by this Chapter, and said walls shall be anchored to such columns by metal anchors in every seven feet to the height of such column.

(m) A structural floor system shall extend from one wall to an opposite wall, and the walls shall be anchored to floor joists or girders or both with iron anchors placed opposite one another, secured to the same joists or girders in pairs, every seven feet or less of length of said walls. Where said joists or girders are of such length that it is not practicable to make them of one piece, then the several pieces shall be joined at each splice or joint by the tie plates or tie bars or other metal connections of the same strength as the anchors. Such anchors shall have not less than four-tenths of a square inch of metal in its smallest cross-sectional area. The spikes, bolts or screws, securing said anchors and tie plates, shall be of such number and size as to transmit the tensile strain which the anchor is capable of resisting into the joists or girders to which said anchors are connected. All pin anchors shall extend at least eight inches into the supporting masonry.

(n) The story height of buildings shall be the distance between structural floor sys-

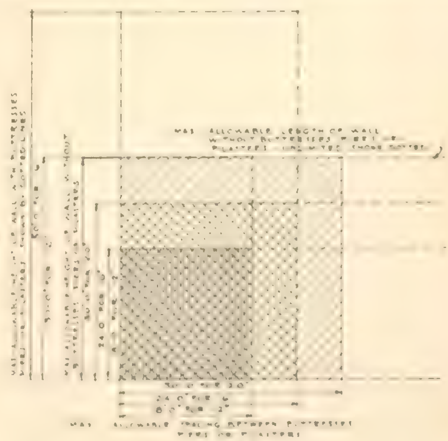


Fig. 18.

Explanatory diagram of maximum allowable height spacing and length of walls with or without buttresses, piers or pilasters.

not more than two stories in height may be of hollow clay tile or moulded hollow concrete blocks not thinner than the thickness herein required for brick walls, subject to the approval of the Commissioner of Buildings.

(r) Interior brick walls used to support fireproof floor construction, where brick walls are not required by this chapter, may be built thinner than the thickness required by the provisions of paragraph (a) of this section, in case the proportion between the thickness of such walls and the free height between floors does not exceed fifteen, and provided the unit stresses do not exceed the stresses allowed by this chapter, and provided further, that no such wall shall be constructed of a thickness less than twelve inches.

and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall, but bonding with brick or masonry will not be considered as complying with this Chapter; and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified. Provided, however, that steel or

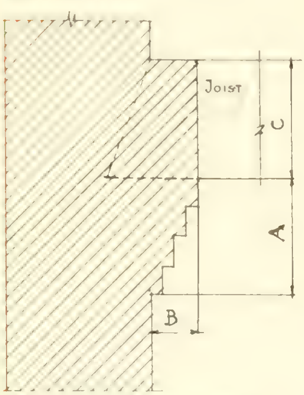


Fig. 19.

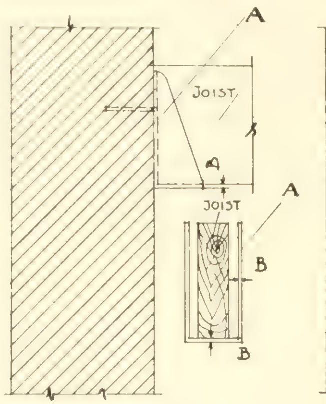


Fig. 20.

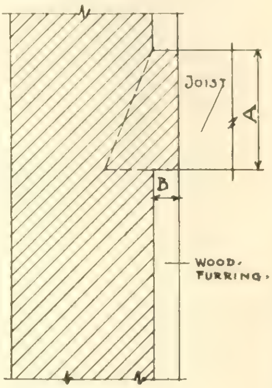


Fig. 21.

LEDGES JOIST SUPPORTS.

Section 733a, b, c.

Fig. 19 (A) Corbelling to be not less than four courses of brick.
(B) Upper course shall project four inches.
(C) The joists shall be protected from top to bottom by brick.

Fig. 20 (A) Metal joist hanger allowable.
(B) ¼ inch metal required.

Fig. 21 (A) Brick shall project between joists.
(B) Projection of brick to be two inches.

733. **Ledges — Joist Supports.)** (a) In buildings two stories or more in height wherever party walls or partition walls twelve inches or less in thickness are used for the support of wood joists in buildings of Classes I, II, IV, V, VII and VIII the joists shall be supported on ledges of brick formed by corbeling not less than four courses of brick and the upper course shall project four inches beyond the face of the wall, and the joists shall be protected from the bottom to the top of same for the distance of the projection of the corbel by solid brick work laid in mortar.

(b) Wherever iron or steel joist and girder boxes having five complete sides of iron, nowhere less than ¼-inch in thickness, are used, corbels and ledges as herein specified may be omitted.

(c) In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring and in no case shall such projection be less than two inches.

734. **Walls of Altered Buildings—Increasing Thickness of.)** If the walls of a building are not of sufficient thickness to comply with the requirements of this Chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, iron columns or beams may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

735. **Walls—Party.)** The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

736. **Walls—Erection of—Walls and Skeleton Framework Securely Braced.)** In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

737. **Parapet Walls—When Required on Walls and Porches—Thickness and Height of.)** (a) On all flat roof buildings parapet walls shall be erected, except as hereinafter provided, on all exterior walls and on all partition walls required by this ordinance by reason of the area of such buildings;

provided, that such parapet walls may be dispensed with on any wall of a fireproof building, and on street and alley walls and on yard and court walls of buildings of other types where the entire framing and materials of the roof are strictly fireproof or where all portions of the roof nearer than fifteen feet to the lot line of such street or alley or bounding such yard or court are protected against fire by a continuous covering of porous or hollow tiles, not less than two inches thick and surfaced with mortar, on top of the roof boards.

(b) Such parapet walls may be eight inches thick wherever this ordinance permits the use of eight-inch walls; elsewhere they shall be not less than twelve inches in thickness.

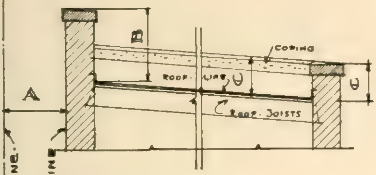


Fig. 22

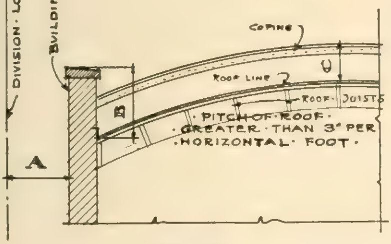


Fig. 23.

Fig. No 22.
A—distance from division lot line to building line.
B—height of parapet wall above roof on division lot line side.
C—parapet wall on other sides when required.
Explanation:
If A is less than 3′0″, B shall be 3′0″.
C shall be not less than 18″.

SECTION 737 D.

Fig. No. 23.
A—distance from division lot line to building line.
B—height of parapet wall above roof, with a greater pitch than 3″ per horizontal foot, on division lot line side.
C—parapet wall on other sides when required.
If A is less than 3′0″, B shall be 3′0″.
C shall not be less than 18″.
For exceptions where fireproof construction is used see ordinance Sec. 737 d, second paragraph.

(c) Such parapet walls shall extend at any point not less than three feet vertically above the roof on all such required partition walls and on all other walls within less than three feet of any division lot line and approximately parallel therewith; elsewhere they shall extend not less than eighteen inches above the roof.

(d) On all buildings whose roofs have a greater pitch than three inches per horizontal foot, parapet walls, of thickness and height as above specified, shall be erected on required partition walls, on exterior walls approximately parallel with and less than three feet distant from a division lot line, and on walls abutting on another building. Provided, that such parapet walls may be dispensed with where the entire framing and materials of the roof are fireproof or where the cornice and roof coverings are of incombustible material and the top of the roof boards is protected against fire for at least five feet up from such wall by a coating of plaster on porous or hollow tiles at least two inches thick; and further provided that such parapet walls and such protection against fire may be dispensed with on buildings of Classes III and VI, three stories or less in height when such buildings have cornices of incombustible material and roof coverings of slate or terra cotta roofing tile.

738. **Allowable Stresses and Special Requirements for Foundations—Bearing on Various Soils.)** (a) If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance other than gravel, it shall not be loaded to exceed 3,500 pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick and is dry and thoroughly compressed, it may be loaded not to exceed 4,500 pounds per square foot.

(b) If the soil is a layer of firm sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it may be loaded not to exceed 5,000 pounds per square foot.

(c) If the soil is a mixture of clay and sand, it shall not be loaded to exceed 3,000 pounds per square foot.

739. **Foundations in Wet Soil—Trenches to Be Drained.)** In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless trenches in which the work is being executed are kept free from water by bailing, pumping, or otherwise, until after the completion of work upon the foundations and until all cement has properly set. In all cases a connection with the street sewer shall be established before beginning the work of laying foundations.

740. **Foundations—Where not Permitted—Depth Below Surface—Independent of Underground Construction Owned or Controlled by the City.)** (a) Foundations must rest on hard sound soil, and shall not be laid or filled or made ground or on loam, or on any soil containing admixture of organic matter. Foundations shall in all cases extend at least four feet below the finished surface of the ground upon which they are built, unless footings rest on bed rock.

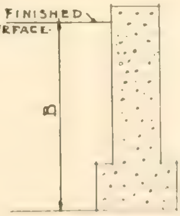


Fig. 24.

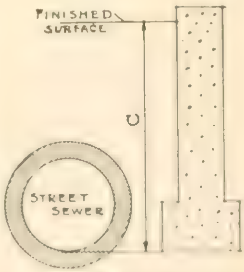


Fig. 25.

FOOTINGS.

Sections 740a, b

Fig. 24 (B) Shall in all cases extend 4′ 0″ below finished grade of building, unless footings rest on bed rock. Sec. 740a.

Fig. 25 (C) Buildings 100 ft. or more in height; footings shall extend at least to a depth drained by sewer in adjacent streets and alleys.

Exception if sewer is greater than 10 ft. below sidewalk grade. Such foundation need not extend to a greater depth than 10 ft. if soil conditions are as per ordinance. Sec. 740b.

(b) Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings 100 feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the adjacent streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

(c) Every building forty feet or more in height, hereafter erected, which is located adjacent to any street or alley containing any then existing water main, water tunnel, sewer, conduit, tunnel, subway or other underground construction, owned or controlled by the City, shall be so constructed that the foundation or superstructure thereof shall not be supported in whole or in part by any such underground construction.

741. **Foundation Construction.)** Foundations shall be constructed of stone, gravel or slag concrete, dimension stone or rubble stone, sewer or paving bricks, iron or steel imbedded in concrete or piles, or a combination of any of the same. All masonry foundations shall be laid in cement mortar.

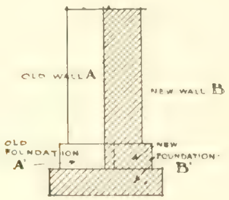


Fig. 26.

SECTION 742.

A—old or present wall.
B—new wall.
A—foundation under old wall.
B—required new foundation.

742. **Foundation of New and Old Walls.)** In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such a manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits specified in this Chapter.

All foundations shall be protected against the effects of frost, and cement mortar which has been affected by frost, shall not be used in building operations.

743. **Foundations—Pile Borings Required—Safe Load Required—Fiber Stress.)** (a) Where pile foundations are used, the Commissioner of Buildings may require auger borings of the soil to be made to determine the position of the underlying stratum of hard clay or rock. The heads of the piles shall be protected against splitting while they are being driven. The piles shall be sawed off to a uniform level at least one foot below Chicago datum after being driven, and the heads shall be imbedded in concrete or covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the stresses in the materials shall not exceed that prescribed in this Chapter. The top of timber grillage shall be at least one foot below Chicago datum.

(b) The center of gravity of a pile foundation shall coincide with the center of gravity line of the load or loads which it carries.

(c) No pile of less than six inches diameter at small end shall be used.

(d) The safe load on a pile shall be determined by and shall not exceed the following formula:

$$P = \frac{2wh}{S + \frac{1}{10}} \text{ for steam hammer;}$$

$$P = \frac{2wh}{S+1} \text{ for drop hammer;}$$

In which formula
S=set in inches.
h=fall in feet.
w=weight of hammer.
P=safe load in pounds.

(e) The maximum load on a timber pile shall not exceed 50,000 pounds.

(f) A wood follower shall not be used in determining the safe load.

(g) Plans for pile foundations shall be submitted to the Commissioner of Buildings for approval and shall specify the least diameter of small end of piles, and no piles with smaller diameter of points than that specified for the job shall be used.

(h) There shall not be less than two rows of piles under all external party walls or other walls less than seventy feet high, and not less than three rows under all walls over seventy feet high, excepting under walls not exceeding fifty feet in height a single staggered row of piles may be used if other conditions of stability are complied with.

744. **Concrete Piles Allowable—Compression—Tests—How Made.** (a) Where concrete piles are used test piles shall be driven and loaded under the general direction of the Commissioner of Buildings.

(b) The allowable compression of concrete piles shall not exceed 400 pounds per square inch at a section six feet from the surface of the ground in immediate contact with the pile.

(c) These tests shall conform to the following regulations: Tests shall be made on at least two piles in different locations and as directed by the Commissioner of Buildings. Not less than three piles to be driven for each test. The pile to be loaded to be driven first, the second pile to be driven within six hours of the driving of the first, the third pile to be driven within twenty to twenty-four hours after the first. The two latter shall each be driven with centers not to exceed twice the greatest diameter of pile, from the center of the test pile.

(d) The tests shall not be started until at least ten days after the piles to be loaded are driven, except that piles that have

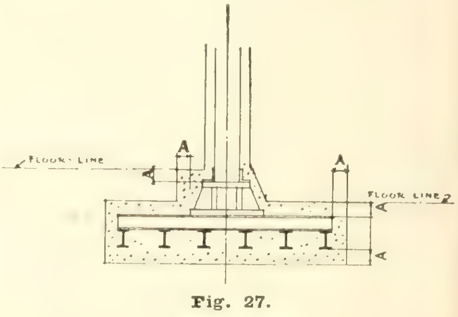


Fig. 27.

Section 745.

(A) Steel and iron rails and beams to be imbedded in concrete, extending not less than 4 inches beyond metal.

(See Special Ruling V, Page 313.)

been cast and set up before driving may be tested as soon as practicable after driving. The piles shall be loaded with twice the proposed carrying load of the piles.

(e) The settlement shall be measured daily until a period of twenty-four hours shows no settlement.

(f) One-half of the test load shall be allowed for the carrying load, if the test shows no settlement for twenty-four hours and the total settlement has not exceeded one one-hundredths of an inch multiplied by the test load in tons.

745. **Steel Rails or Beams in Concrete.)** If steel or iron rails or beams are used as parts of foundations, they shall be entirely imbedded in concrete extending not less than four inches beyond the metal.

746. **Allowable Stresses and Special Requirements for Masonry.)** (a) Allowable stresses in pounds per square inch on plain concrete and stone masonry shall not exceed the following:

	Lbs.
Coursed rubble Portland cement mortar	200
Ordinary rubble Portland cement mortar	100
Coursed rubble lime mortar	120
Ordinary rubble lime mortar	60
First-class granite masonry, Portland cement mortar	600
First-class lime and sandstone masonry, Portland cement mortar	400
Portland cement concrete 1-2-4 mixture, machine mixed	400
Portland cement concrete 1-2-4 mixture, hand mixed	350
Portland cement concrete 1-2½-5 mixture, machine mixed	350
Portland cement concrete 1-2½-5 mixture, hand mixed	300
Portland cement concrete 1-3-6 mixture, machine mixed	300
Portland cement concrete 1-3-6 mixture, hand mixed	250
Natural cement concrete 1-2-5 mixture	150

(b) Allowable compression in pounds per square inch on brick masonry shall not exceed the following:

	Lbs.
No. 1 paving brick, 1 part Portland cement, 3 parts torpedo sand	350
No. 2 pressed brick and sewer brick, mortar same as referred to above	250
No. 3 hard common select brick, Portland cement mortar, same as referred to above	200
No. 4 hard common select brick, 1 part Portland, 1 lime, 3 sand as referred to above	175
No. 5 common brick, all grades, Portland cement mortar	175
No. 6 common brick, all grades, good lime and cement mortar	125
No. 7 common brick, all grades, natural cement mortar	150
No. 8 common brick, all grades, good lime mortar	100

(c) Brick under Nos. 1 and 2 shall not crush at less than 5,000 pounds pressure per square inch of gross area.

(d) Brick under Nos. 3 and 4 shall not crush at less than 2,300 pounds pressure per square inch of gross area.

(e) Brick under Nos. 5, 6, 7 and 8 shall not crush at less than 1,800 pounds pressure per square inch of gross area. Sand lime brick of this crushing strength may be used where common brick is permitted.

(f) Isolated piers of concrete, brick, or masonry shall not be higher than six times their smallest dimensions unless the above unit of stresses are reduced according to the following formula:

$$P \text{ equals } C\left(1.25 \text{ minus } \frac{H}{20D}\right)$$

In which formula

P is the reduced allowed unit stress.
C is the unit stress in the above table.
H is the height of the pier in feet.
D is the least dimension of the pier in feet.

(g) No pier shall exceed in height twelve times the least dimension. Weight of pier shall be added to other loads in computing load coming on the pier.

747. **Definition of Terms Used for the Construction of Walls.)** (a) Wherever the terms masonry, masonry walls or masonry construction, incombustible wall, fireproof wall or wall of fireproof or incombustible material are used with reference to or in connection with the construction of walls in this chapter, such terms are hereby defined to mean solid walls of brick, stone or concrete, built of solid material, except such walls as are allowed under the provisions of Section 779 of this chapter. Where brick is used in the construction of any wall, the length and thickness of such brick may vary, but each brick must be at least three and seven-eighths inches in width.

(b) Ordinary rubble is hereby defined as masonry composed of unsquared stones laid without attempting any regularity of courses or bond.

Coursed rubble is hereby defined as masonry having approximately level joints; stones to be roughly shaped so as to fit approximately; joints in wall or pier to be leveled off every three (3) feet in height and to be well bonded.

First class masonry is hereby defined as masonry built of stones in regular courses, the bearing surfaces of which as well as ends, to be roughly tooled off and shall be laid with alternate headers and stretchers so as to secure perfect bond.

748. **Ashlar Facing.)** (a) Ashlar facing of masonry walls shall only be considered as part of wall for the purpose of carrying weight, when it has a minimum bond as follows:

(b) Every second course to be a bond course, this bond course to extend into the backing a distance equal to the least thickness of ashlar. In addition to such bond, each stone in all courses shall be tied to backing by two galvanized iron anchors. No ashlar shall be less than four inches thick, nor shall the height of any stones exceed five times its thickness.

749. **Soft Bricks—Where Not Permitted.)** Soft bricks shall not be used in any part of a building where exposed to the weather, nor in external or internal piers of bearing walls.

750. **Brickwork—Bond of.)** The bond of all brickwork shall be formed by laying one course of headers for every five courses of stretchers; provided that in the case of pressed brick facing, two headers and a stretcher may be laid alternately in every course or an equivalent number of full headers may be used in any other arrangement approved by the Commissioner of Buildings; and provided further, that pressed brick facing, when not counted as part of the bearing wall, may be laid with fewer or no header courses if anchored to the backing by metal ties of design, material, weight and quantity approved by the Commissioner of Buildings.

751. **Bricks—How Laid.)** All brick laid up in cement, or lime and cement mortar, shall be thoroughly drenched immediately before being laid unless laid in freezing weather. Both horizontal and vertical joints shall be filled with mortar in all kinds of brick masonry.

752. **Allowable Stresses and Special Requirements for Timber.)** The maximum allowable stresses in pounds per square inch on actual sections for timber shall be as follows

	Extreme Fibre Stress and Tension with Grain.	Compression with Grain.	Compression Across Grain in Buildings Hereafter Erected.	*Compression Across Grain in Existing Buildings.*	Shear with Grain.
Douglas Fir and Long Leaf Yellow Pine....	1,300	1,100	250	*400*	130
Oak	1,200	900	500	*600*	200
Short Leaf Yellow Pine....................	1,000	800	250	*300*	120
Norway Pine	800	700	200	*300*	80
White Pine	800	700	200	*300*	80
Hemlock	600	500	150	*300*	60

The unit stress on timber posts shall comply with the following formula:

$$C = 1 - \left(\frac{L}{80D}\right)$$

In the above formula:

C equals compressive strength of timber with the grain as given in the table
L equals length in inches.
D equals least diameter inches.

The maximum length of a timber post shall not exceed thirty diameters.

Timber columns shall not be used in buildings of greater height than twice the width of the building nor in buildings over one hundred feet in height.

753. **Quality of Timber.)** Timber used for building purposes shall be sound, well manufactured, close grained, free from wind shakes, or from dead, loose, decayed, encased or pitch knots, or knots and other defects that will materially impair its strength and durability.

754. **Maximum Allowable Stresses and Special Requirements for Metals.)** (a) The maximum allowable stresses in pounds per square inch in steel and iron shall not exceed the following:

	Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron.
Tension on net section..............................	16,000	16,000	12,000	......
Maximum compression on gross section................	14,000	14,000	10,000	10,000
Bending on extreme fibre............................	16,000	16,000	12,000	......
Bending on extreme fibre tension....................	......	......	......	3,000
Bending on extreme fibre compression................	......	......	......	10,000
Bending on extra fibres of pins.....................	25,000	......	......	......
Shear: shop driven rivets and pins..................	12,000	......	......	......
Shear: field driven rivets..........................	10,000	......	......	......
Shear on rolled steel shapes........................	12,000	......	......	.....
Shear plate girder webs; gross section..............	10,000	......	......	......
Shear on brackets	......	......	......	2,000
Bearing, shop driven rivets and pins................	25,000	......	......	.....
Bearing, field rivets	20,000	......	......	......

(b) The allowable compressive stresses per square inch shall be determined by the following formulæ:

Steel .... $16{,}000 - 70\frac{L}{R}$

Wrought iron .... $12{,}000 - 60\frac{L}{R}$

Cast iron .... $10{,}000 - 60\frac{L}{R}$

In the above formulæ:

L equals length in inches.
R equals least radius of gyration in inches.

(c) In no case shall the allowable compressive stress exceed that given in paragraph (a) of this section.

(d) For steel columns filled with, and encased in concrete extending at least three inches beyond the outer edge of the steel, where the steel is calculated to carry the entire live and dead load, the allowable stress per square inch shall be determined by the following formula:

$$18{,}000 - 70\frac{L}{R},$$

but shall not exceed 16,000 pounds.

(e) For steel columns filled with, but not encased in, concrete the steel shall be calculated to carry the entire live and dead load. In this case the above formula may be used, but the allowable stress shall not exceed 14,000 pounds.

(f) Stresses due to eccentric loading shall be provided for in all compressive members.

(g) The length of rolled steel compressive members shall not exceed one hundred twenty times the least radius of gyration, but the limiting length of struts for wind bracing only may be one hundred fifty times the least radius of gyration. The limiting length for cast iron columns shall be seventy times the least radius of gyration.

(h) Cast iron columns shall not be used in buildings of greater height than twice the least width, or in buildings over 100 feet high.

(See Special Ruling VIII, Page 301.)

755. **Live and Dead Loads—Stress.)** (a) Wherever the live and dead load stresses are of opposite character, only 70 per cent of the dead load stress shall be considered as effective in counteracting the live load stress.

(b) For stresses produced by wind forces combined with those from live and dead load, the unit stress may be increased fifty per cent. over those given above; but the section shall not be less than required if wind forces be neglected.

756. **Riveting—Tension.)** (a) In proportioning tension members the diameter of the rivet holes shall be taken one-eighth of an inch larger than the nominal diameter of the rivet.

(b) In proportioning rivets the nominal diameter of the rivet shall be used.

(c) Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent in excess of the net section of the body of the member and the net section back of the pin-hole, parallel with the axis of the member, shall not be less than the net section of the body of the member.

757. **Plate Girders — Flanges — Compression.)** (a) Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the flanges are concentrated at their centers of gravity and a unit stress used such that the extreme fibre stress does not exceed 16,000 pounds per square inch, in which case one-eighth of the gross section of the web, if properly spliced, may be used as flange section.

(b) The gross section of the compression flanges of plate girders shall not be less than the gross section of the tension flanges; nor shall the stress per square inch in the compression flange of any beam or girder of a longer length than 25 times the width exceed.

$$20{,}000 - 160\frac{L}{B}$$

In which formula

L equals unsupported distance and
B equals width of flange.

(c) The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the effective depth of the girder at that point combined with any load that is applied directly on the flanges.

(d) Webs of plate girders shall be provided with stiffeners over all bearing points, under all points of concentrated loading and elsewhere when required by good engineering practice.

Reinforced Concrete.

(See Special Ruling II and III, Page 305.)

758 **Reinforced Concrete — Definition — Plans.)** The term "Reinforced Concrete" is hereby defined as any combination of metal imbedded in concrete to form a structure so that the two materials assist each other to sustain all the stresses imposed. Before a permit to erect any reinforced concrete structure is issued, complete plans and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, including detail of working joints, the size and position of all reinforced rods, stirrups or other forms of metal, and giving the composition and proportion of the concrete; provided, however, that permission to erect any reinforced concrete structure does not in any manner approve the construction until after tests have been made of the actual construction to the satisfaction of the Commissioner of Buildings.

(See Special Ruling III, Page 305.)

759. **Ratio of Moduli of Elasticity—Adhesion—Bond.)** (a) The calculations for the strength of reinforced concrete shall be based on the assumed ultimate compressive strength per square inch designated by the letter "U" given in the table below for the mixture to be used.

(b) The ratio designated by the letter "R" of the modulus of elasticity of steel to that of the different grades of concrete shall be taken in accordance with the following table:

Mixture.	U	R
1 cement, 1 sand, 2 broken stone, gravel or slag	2,900	10
1 cement, 1½ sand, 3 broken stone, gravel or slag	2,400	12
1 cement, 2 sand, 4 broken stone, gravel or slag	2,000	15
1 cement, 2½ sand, 5 broken stone, gravel or slag	1,750	18
1 cement, 3 sand, 7 broken stone, gravel or slag	1,500	20

(See Special Ruling II, Page 305.)

760. **Unit Stresses for Steel and Concrete.)** (a) The stresses in the concrete and the steel shall not exceed the following limits:

(b) Tensile stress in steel shall not exceed one-third of its elastic limits and shall not exceed 18,000 pounds per square inch.

(c) Shearing stress in steel shall not exceed 12,000 pounds per square inch.

(d) The compressive stress in steel shall not exceed the product of the compressive stress in the concrete multiplied by the elastic modulus of the steel and divided by the elastic modulus of the concrete.

(e) Direct compression in concrete shall be one-fifth of its ultimate strength. Bending in extreme fibre of concrete shall be thirty-five one-hundredths of the ultimate strength.

(f) Tension in concrete on diagonal plane shall be one-fiftieth of the ultimate compressive strength.

(g) For a concrete composed of one part of cement, two parts of sand and four parts of broken stone, the allowable unit stress for adhesion per square inch of surface of imbedment shall not exceed the following:

	Pounds Per Sq. Inch.
On plain round or square bars of structural steel	70
On plain round or square bars of high carbon steel	50
On plain flat bars, in which the ratio of the sides is not more than 2 to 1	50
On twisted bars when the twisting is not less than one complete twist in eight diameters	100

(h) For specially formed bars, the allowable unit stress for bond shall not exceed one-fourth of the ultimate bond strength of such bars without appreciable slip which shall be determined by tests made by the person, firm or corporation engaged in such construction work to the satisfaction of the Commissioner of Buildings, but provided that in case shall such allowable unit stress exceed 100 pounds per square inch of the specially formed bars.

761. **Design for Slabs, Beams and Girders.)** Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(a) The common theory of flexure shall be applied to beams and members resisting bending.

(b) The adhesion between the concrete and the steel shall be sufficient to make the two materials act together.

(c) The steel to take all the direct tensile stresses.

(d) The stress strain curve of concrete in compression is a straight line.

(e) The ratio of the moduli of elasticity of concrete to steel shall be as specified in the table in Section 759.

(See Special Ruling II and IV, Pages 305 and 311.)

762. **Moments of External Forces.)** (a) Beams, girders, floor or roof slabs and joists shall be calculated as supported, or with fixed ends, or with partly fixed ends, in accordance with the actual end conditions, the number of spans and the design.

(b) When calculated for ends partly fixed for intermediate spans with an equally distributed load where the adjacent spans are of approximately equal lengths:

Bending moment at center of spans shall not be less than that expressed in the following formula $\frac{WL^2}{12}$ for intermediate spans and $\frac{WL^2}{10}$ for end spans:

(c) The moment over supports shall not be less than the formula $\frac{WL^2}{18}$ and the sum of the moments over one support and at the center of span shall be taken not less than the formula $\frac{WL^2}{6}$.

In the formulas hereinabove given "W" is the load per lineal foot and "L" the length of span in feet.

(d) In case of concentrated or special loads the calculations shall be based on the critical condition of loading.

(e) For fully supported slabs, the free opening plus the depth, for continuous slabs, the distance between centers of supports, is to be taken as the span.

(f) Where the vertical shear, measured on the section of a beam or girder between the centers of action of the horizontal stresses, exceeds one-fiftieth of the ultimate direct compressive stress per square inch, web reinforcement shall be supplied sufficient to carry the excess. The web reinforcement shall extend from top to bottom of beam, and loop or connect to the horizontal reinforcement. The horizontal reinforcement carrying the direct stresses shall not be considered as web reinforcement.

(g) In no case, however, shall the vertical shear, measured as stated above, exceed one-fifteenth of the ultimate compression strength of the concrete.

(h) For T beams the width of the stem only shall be used in calculating the above shear.

(i) When steel is used in the compression side of beams and girders, the rods shall be tied in accordance with requirements of vertical reinforced columns with stirrups connecting with the tension rods of the beams or girders.

(j) All reinforcing steel shall be accurately located in the forms and secured against displacement; and inspected by the representative of the architect or engineer in charge before any surrounding concrete be put in place. It shall be afterwards completely inclosed by the concrete, and such steel shall nowhere be nearer the surface of the concrete than 1½-inch for columns, 1½ inch for beams and girders, and ½-inch, but not less than the diameter of the bar, for slabs.

(k) The longitudinal steel in beams and girders shall be so disposed that there shall be a thickness of concrete between the separate pieces of steel of not less than one and one-half times the maximum sectional dimension of the steel.

(l) For square slabs with two-way reinforcements the bending moment at the center of the slab shall not be less than that expressed in the formula $\frac{WL^2}{24}$ for intermediate spans, and $\frac{WL^2}{20}$ for end spans.

(m) The moment over supports shall not be less than the formula $\frac{WL^2}{36}$ and the sum of the moments over one support and at the center of the span shall be taken not less than the formula $\frac{WL^2}{12}$.

In which above formula "W" is the load per lineal foot and "L" the length of the span.

(n) For squares or rectangular slabs, the distribution of the loads in the two directions, shall be inversely as the cubes of the two dimensions.

(o) Exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and the plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and so secured as to meet the approval of the Commissioner of Buildings.

(p) Shrinkage and thermal stresses shall be provided for by introduction of steel.

(See Special Ruling II, Page 305.)

763. **Limiting Width of Flange in "T" Beams.)** (a) In the calculation of ribs, a portion of the floor slab may be assumed as acting in flexure in combination with the rib. The width of the slab so acting in flexure is to be governed by the shearing resistance between rib and slab, but limited to a width equal to one-third of the span length of the ribs between supports and also limited to a width of three-quarters of the distance from center to center between ribs.

(b) No part of the slab shall be considered as a portion of the rib, unless the slab and rib are cast at the same time.

(c) Where reinforced concrete girders support reinforced concrete beams, the portion of floor slab acting as flange to the girder must be reinforced with rods near the top, at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams.

(See Special Ruling IV, Page 311.)

764. **Reinforced Concrete Columns—Limit of Length—Per Cent of Reinforcement—Bending Moment in Columns—Tying Vertical Rods.)** (a) Reinforced concrete may be used for columns in which the concrete shall not be leaner than a 1:2:4 mixture and in which the ratio of length to least side or diameter does not exceed twelve, but in no case shall the cross section of the column be less than 64 square inches. Longitudinal reinforcing rods must be tied together to effectively resist outward flexure at intervals of not more than twelve times least diameter of rod and not more than 18 inches. When compression rods are not required, reinforcing rods shall be used, equivalent to not less than one-half of one per cent of the cross sectional area of the column; provided, however, that the total sectional area of the reinforcing steel shall not be less than one square inch, and that no rod or bar be of smaller diameter or smaller least dimensions than one-half inch. The area of reinforcing compression rods shall be limited to three per cent. of cross sectional area of the column. Vertical reinforcing rods shall extend upward or downward into the column, above or below, lapping the reinforcement above or below enough to develop the stress in rod by the allowable unit for adhesion. When beams or girders are made monolithic with or rigidly attached to reinforced concrete columns, the latter shall be designed to resist a bending moment equal to the greatest possible unbalanced moment in the beams or girders at the columns, in addition to the direct loads for which the columns are designed.

(b) When the reinforcement consists of vertical bars and spiral hooping, the concrete may be stressed to one-fourth of its ultimate strength as given in Section 759, provided, that the amount of vertical reinforcement be not less than the amount of the spiral reinforcement, nor greater than eight per cent. of the area within the hooping; that the percentage of spiral hooping be not less than one-half of one per cent. nor greater than one and one-half per cent.; that the pitch of the spiral hooping be uni-

form and not greater than one-tenth of the diameter of the column, nor greater than three inches; that the spiral be secured to the verticals at every intersection in such a manner as to insure the maintaining of its form and position, that the verticals be spaced so that their distance apart, measured on the circumference be not greater than nine inches, nor one-eighth the circumference of the column within the hooping. In such columns, the action of the hooping may be assumed to increase the resistance of the concrete equivalent to two and one-half times the amount of the spiral hooping figured as vertical reinforcement. No part of the concrete outside of the hooping shall be considered as a part of the effective column section.

765. **Structural Steel Columns.)** When the vertical reinforcement consists of a structural steel column of box shape, with lattice or battenplates of such a form as to permit its being filled with concrete, the concrete may be stressed to one-fourth of its ultimate strength as given in table in Section 759, provided that no shape of less than one square inch section be used and that the spacing of the lacing or battens be not greater than the least width of the columns.

(See Special Ruling X, Page 313.)

766. **Curtain Walls in Skeleton Construction Buildings.)** Buildings having a complete skeleton construction of steel or of reinforced concrete construction, or a combination of both, may have exterior walls of reinforced concrete eight inches thick; provided, however, that such walls shall support only their own weight and that such walls shall have steel reinforcement of not less than three-tenths of one per cent in each direction, vertically and horizontally, the rods spaced not more than twelve-inch centers and wired to each other at each intersection. All bars shall be lapped for a length sufficient to develop their full stress for the allowable unit stress for adhesion. Additional bars shall be set around openings, the verticals wired to the nearest horizontal bars, and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars. The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured so as to resist a pressure of thirty pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

767. **Bending and Elongation of Steel.)** The bending and elongation of steel used in reinforced concrete construction shall conform to the following requirements: (a) Steel having a diameter of three-fourths of an inch or less shall be capable of bending cold ninety degrees over a diameter equal to twice the thickness of the piece without fracture; steel over three-fourths inch in diameter shall be capable of bending cold to ninety degrees over a diameter equal to three times the diameter of the piece.

(b) The material of reinforcement shall be such form that it will not elongate under working stress to exceed one fifteen-hundredth.

(c) Reinforcing steel used in reinforcing concrete construction shall not be painted, but shall be free from all mill scale and loose rust.

768. **Cement Tests.)** (a) Only Portland cement shall be used in reinforced concrete construction. All cement shall be tested in car load lots when delivered, or in quantities equal to the same. Cement failing to meet the requirements of accelerated test shall be rejected.

(b) Pats of neat cement must be allowed to harden twenty-four hours in moist air, and then be submitted to the accelerated test as follows: A pat is exposed in any convenient way in an atmosphere of steam, and above boiling water, in a loosely closed vessel for three hours, after which before the pat cools, it is placed in the boiling water for five additional hours. To pass this test satisfactorily, the pat shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

(c) Portland cement when tested shall have a minimum tensile strength as follows: Neat cement after one day in moist air shall develop a tensile strength of at least 200 pounds per square inch; after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch, and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 600 pounds per square inch. Cement and sand tests composed of one part of cement and three parts of sand shall after one day in air and six days in water, develop a tensile strength of at least 175 pounds per square inch; and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 240 pounds per square inch.

(d) A certificate that the cement used has been tested and has met the requirements of this section and that the tests have been made in accordance with the standard specifications and tests for Portland cement as adopted by the American Society for Testing Materials, and by the United States Government adopted 1904; revised 1908, 1909, 1917 and 1921—serial designation C 9-21, shall be furnished by the architect or engineer in charge to the Commissioner of Buildings.

769. **Sand.)** The sand to be used for concrete shall be clean, hard, coarse sand, of the grade known as torpedo sand, and free from loam or dirt, not less than 45 per centum shall be returned on a screen of 400 mesh to the square inch.

770. **Stone.)** The stone to be used in concrete shall be clean crushed hard stone or clean crushed blast furnace slag or gravel of a size to pass through a one-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using. If slag is used, it shall be of such character that when made into concrete the concrete will develop a crushing strength equal to that specified for stone or gravel concrete.

771. **Mixing.)** All concrete shall be mixed in a mechanical mixer except when limited quantities are required, or when the conditions of the work make hand mixing preferable; hand mixing to be done only when approved by the Commissioner of Buildings. In all mixing, the separate ingredients shall be measured and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing.

772. **Placing Concrete.)** In filling in concrete around reinforcing steel, the concrete must be worked continuously with suitable tools, as it is put in place. Filling the forms completely and puddling afterward will not be permitted. In placing the concrete, the work shall be so laid out that partly set concrete will not be subjected to shocks from men wheeling or handling material over it.

773. **Concrete Placed in Freezing Weather.)** When concreting is carried on in freezing weather, the material must be heated, and such provisions made that the concrete can be put in place without freezing. The use of frozen, lumpy sand, or stone depend-

ing on hot water used in mixing to thaw it out will not be permitted. All reinforced concrete shall be kept at a temperature above freezing for at least forty-eight hours after being put in place. All forms under concrete placed in freezing weather shall remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

774. **Concrete Placed in Warm Weather.)** Concrete laid in warm weather shall be drenched with water twice daily, Sunday included, during the first week after being put in place.

775. **Cement Finish.)** Cement finish added to the top of slabs, beams, or girders, shall not be calculated in the strength of a member unless laid integrally with the rough concrete. No greater unit stress shall be allowed on such cement finish than on the rough concrete.

(See Special Ruling IV, Page 311.)
(See Special Ruling IX, Page 313.)

776. **Fireproof Concrete Construction.)** Reinforced concrete construction will be accepted for fireproof buildings if designed as prescribed in this paragraph. The aggregate for such concrete shall be clean, broken stone or clean crushed blast furnace slag, or clean screened gravel, together with clean, coarse sand of the grade known as torpedo sand; stone, slag or gravel shall be of a size to pass through a screen of three-quarter inch square mesh. The minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and girders shall be two inches on the bottom, and one and one-half inches on the sides of said beams and girders. The minimum thickness of concrete under slab rods shall be one inch; and all reinforcement in columns shall have a minimum protection of two inches of concrete except as hereinafter provided, if a supplementary metal fabric is placed in the concrete surrounding the reinforcing, simply for holding the concrete, the thickness of concrete under the reinforcing may be reduced by one-half inch, then such fabric shall not be considered as reinforcing metal.

777. **Removal of Forms.)** In no case shall the props and shores used in reinforced concrete construction be removed from under floors and roofs in less than two weeks, except as is provided herein. Column forms shall not be removed in less than four days. The centering from bottom of slabs and sides of beams and girders may be removed after the concrete has set for one week, if the floor has obtained sufficient hardness to sustain the dead weight of the said floor. No load or weight shall be placed on any portion of the construction until the concrete has fully set and the centers have been removed.

778. **Tests.)** The contractor for the reinforced concrete construction shall make load tests on any portion of the work within a reasonable time after erection, as may be required by the Commissioner of Buildings. Such tests must be made under the direction of the Commissioner of Buildings in his presence or in the presence of his representative, and must show that the construction will sustain a load twice the sum of the live and dead loads for which it was designed, without any sign of failure. The construction may be considered as part of the test load. Each test load shall cover two or more panels and shall remain in place at least twenty-four hours. The deflection under the full test load at the expiration of twenty-four hours shall not exceed one eight-hundredth of the span. These tests shall be considered as tests of workmanship only.

779. **Reinforced Terra Cotta Hollow Tile.)** (a) The term reinforced hollow tile is hereby defined to mean a system of hollow burned clay tile in combination with reinforced concrete, in which combination the hollow tile may be used to resist compressive and shearing stresses subject to the following provisions:

The provisions relating to reinforced concrete construction shall hold as far as applicable to this system.

All tile to be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having an ultimate compressive strength of not less than 4,000 pounds per square inch of net area of surface tested.

The following stresses and values shall not be exceeded: Extreme fibre stress (compressive) on hollow tile, 500 pounds per square inch.

Shearing stress on hollow tile, forty pounds per square inch.

Adhesion between tile and 1:2:4 concrete or 1:3 cement mortar, twenty pounds per square inch.

Ratio of modulus of elasticity of steel to that of tile with cement mortar joints, 10.

(b) The hollow tile shall be thoroughly soaked with water at the time concrete is poured and be kept drenched for at least thirty-six hours afterwards. The joints between tiles shall be staggered, buttered and slushed full of mortar consisting of one (1) part of Portland cement and three (3) parts of clean, sharp sand, thoroughly mixed.

(c) Columns of solid terra cotta or of hollow terra cotta in which the sectional area of the open holes in each block shall not exceed twenty (20) per cent of the gross sectional area of such block, may be used for structural purposes provided the height of such column shall not exceed twelve times the least dimension.

The allowable stress shall not exceed 350 pounds per square inch and shall be subject to the reduction formula given in Section 746 in paragraph f.

All terra cotta tile used for construction of columns shall be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having ultimate compressive strength of not less than 6,000 pounds per square inch of net area of cross section of samples tested.

Mortar used in setting terra cotta tile walls and columns to be composed of one (1) part Portland cement and three (3) parts clean, sharp sand, thoroughly mixed.

(d) All terra cotta tile must be thoroughly wet before using and when used in columns must be set on end with the voids running vertically and directly over each other, and with the webs in direct line of pressure.

All vertical joints must stagger and terra cotta blocks must be of proper dimensions to meet this condition as no broken tile will be allowed.

All work to be set plumb, with uniform horizontal joints, thickness to average three-eighths (3-8) of an inch. The minimum time which shall elapse between the finishing of the work and before any load is placed thereon shall be not less than seven days.

(e) Hollow tile may be used for building primary bearing walls, which are defined as walls that may be used to receive directly the loads from floors or roofs in addition to their acting as partition walls, provided the proportion between thickness of wall and free height between the floors does not exceed fifteen (15) and the load including the weight of the construction does not exceed three

hundred and fifty (350) pounds per square inch of net sectional area of tile, and shall be of the thickness specified by this chapter for brick walls. Hollow terra cotta tile may be used for exterior walls, but when so used the thickness and height of the work must conform to the dimensions required for brick walls in this chapter, but must in no case exceed four stories in height in any building. The thickness of walls shall be calculated as the outside dimensions of the tile and each tile shall be full thickness of wall. The thickness of the plastering is not to be included as a part of the thickness of the wall. Walls having a thickness of 4 inches may be used when the height does not exceed five (5) feet. The quality and gross sectional area of the tile and mortar and special provisions as to workmanship as specified for terra cotta columns shall apply to terra cotta tile walls.

(f) Fireproof storage bin, grain elevators and grain warehouses may be built in cylindrical form with terra cotta tile of such height, diameter and thickness as is allowed by safe engineering practices, provided that the material shall not be stressed in excess of the limits prescribed in this chapter for walls and columns.

780. **Cinder Concrete.** (a) Cinder concrete construction may be used for all buildings in which fire-proof construction is mandatory by this chapter, or where ordinary construction, mill construction or slow-burning construction may be used.

(b) Only clean, thoroughly burnt, steam boiler cinders, free from matter other than cinders may be used. The cinders used shall be of such size that they will pass through a one-inch square mesh. Cinder concrete piers or walls shall not be permitted to carry loads and shall not be given credit therefor.

(c) The ultimate compressive strength per square inch of cinder concrete shall be taken as not exceeding seven hundred pounds. The ratio of the modulus of elasticity of steel divided by the modulus of elasticity of cinder concrete shall be taken as thirty.

(d) There shall not be less than one part of Portland cement to seven parts of cinders and sand of the grade known as torpedo sand in cinder concrete. All other special requirements and methods of calculation for reinforced concrete as required in this chapter shall modify and regulate the use of cinder concrete in buildings.

(e) All steel and all metal pipe and conduits enclosed in cinder concrete shall be protected by a coating of cement grout or plastered with good lime mortar before the cinder concrete is placed.

(f) For fireproof construction, the minimum thickness of cinder concrete covering on structural metal shall be the same as required for brick or concrete covering for fireproof buildings by this chapter. In slow-burning or mill construction buildings, the minimum thickness of cinder concrete covering on structural metal shall be three inches on columns and two inches on beams, girders and other structural steel or iron members.

(g) Wherever cinder concrete is used for the covering of columns, beams, girders or other structural steel members of a building the cinder concrete covering shall have metal binders, or wire fabric, imbedded in and around said columns, beams, girders or other structural steel members. If wire is used for said metal binders, it shall not be smaller than No. 8 gauge wire and shall be spaced not less than sixteen inches apart along the length of the steel member covered.

(h) Where cinder concrete construction is used for a building which, by this chapter, is required to be of fireproof construction, all parts that carry weights or resist strains, shall be made entirely of incombustible material, and all metallic structural members shall be protected against the effects of fire by cinder concrete proportioned, mixed, applied and secured as herein described.

(i) All other parts of a building of cinder concrete construction, built where fireproof construction is mandatory by this chapter, shall be built and made of the material required by this chapter for buildings of fireproof construction; provided, however, that cinder concrete as described herein, and of the same thickness elsewhere specified, may be used for all protective covering of structural metal, after such metal has been protected by a coating of cement grout or plastered with good lime mortar, as required by this chapter.

Skeleton Construction.

(See Special Ruling I, Page 305.)

781. **Skeleton Construction.)** (a) The term "Skeleton Construction" shall apply to all buildings wherein all external and internal loads and stresses are transmitted from the top of the building to the foundations by a skeleton or framework of metal or reinforced concrete.

(b) In metal frame skeleton construction the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders shall have riveted connections to unite them with the columns. If cast iron columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than ¾ inch in diameter, and the beams and girders shall be bolted to the columns. Bolt holes in flanges for connection from column to column shall be drilled. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

(c) All steel trusses shall be riveted and the steel work in buildings more than 100 feet high and in a building whose height exceeds twice its width shall be riveted.

(d) Wherever it is found impossible to rivet connections as herein described and such connections are bolted, cold rolled or turned bolts of exact fit and diameter in reamed holes may be used in place of rivets with the same allowable stresses as field driven rivets.

(e) All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

(f) After the bases or base plates and columns have been set in place, both shall be protected by a covering of cement concrete applied direct to the metal, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations to an elevation six feet above the floor level nearest the column base plate or column stool.

(g) All metal shall be clean and shall be free from loose rust and scale, and all metal except that to be embedded in concrete shall be protected with at least two coats of metal protecting paint.

(h) All structural details and workmanship shall be in accordance with accepted engineering practice.

(i) All trusses shall be held rigidly in position, both temporarily and permanently by efficient lateral and sway bracing.

Miscellaneous Provisions.

782. **Porches—Verandas—Porticos—Construction of Inside Fire Limits.)** (a) The enclosing walls of porches, verandas, or porticos shall be of incombustible material on buildings inside the fire limits, except that where such porches, verandas, or porticos constitute part of a storm house or of a storm door enclosure, they may be of combustible material, provided, that they be not more than twelve feet high, nor occupy a greater frontage than two feet more than the width of the inner doors protected by such storm enclosure.

(b) On buildings more than three stories in height, porches hereafter erected, if of combustible material, shall not exceed one story in height. Where porches of incombustible material are continuous and extend fifty feet or more across the rear of buildings, there shall be a partition of incombustible material separating each fifty feet of porch from the adjacent porch.

783. **Tanks on Roofs—Permits—Fees.)** It shall be unlawful for any person, firm or corporation to construct, maintain or allow, or permit to remain in or upon the roof of any building in the city, any tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction. No tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building without first submitting for the approval of the Commissioner of Buildings a complete set of plans, showing the construction in detail of the supports and foundations of such tank. If such plans shall be satisfactory to the Commissioner of Buildings, they shall be approved by him. The owner or his agent or the contractor erecting such tank shall, before proceeding with the erection of such tank, procure from the Department of Buildings a permit for the sub-structure work, for which permit a fee of five dollars shall be charged.

784. **Door and Window Openings, When Protected in Buildings of Classes I, II, IV, V, VII and VIII—Iron Doors—Wired Glass Set in Metal Frames.)**

(See Illustration, Sec. 476a.)

(a) Where the distance from door to window openings in buildings of Classes I, II, IV, V, VII and VIII is less than thirty (30) feet from the opposite side of the established alley line and where the windows and doors of two or more areas of the same building which is required to be separated by dividing walls by this chapter, are on a court, every such window and door, distant less than thirty feet from another window or door of another such area and also where the doors and window openings are within fifteen (15) feet of an inside lot line, such openings shall be provided with windows and doors constructed of wire glass set in metal frames and sash; provided, further, that doors may be automatic rolling steel shutters or steel plate doors or metal-clad wood doors, and further provided that at least one of the first or ground floor doors must be a swinging door.

(b) Where iron doors are used to fulfill the requirements of this section they shall be made of sheet iron or steel, of not less than No. 14 U. S. gauge metal, and shall lap the wall at least one-half inch all around the opening, and the bottom shall fit the sill closely where it is not practicable to lap it. The frames and crossbars shall be made of one and one-half by one and one-half by one-fourth inch angles and in no case shall there be less than two crossbars, and where the doors are over six feet high, such crossbars shall be placed not more than two feet apart. Lever bars shall be made of one and one-half by three-eighths inch iron, extending at least one-third of the distance across the opposite leaf. The number and spacing of such lever bars shall be the same as the crossbars. Where hinges are used they shall be made of two by one-fourth inch iron, extending at least three-fourths of the way across the door. The number and spacing of such hinges shall be the same as is required for the crossbars. Pin bolt or eyes shall be one-half inch round and shall be securely fastened to the building.

(c) Where metal frames, metal sash and wired glass are used to fulfill the requirements of this section, the glazed portion of the frames and sash shall be set with fire-resisting glass such as is elsewhere herein defined. The glass must be supported by frames and sash and shall be retained by the structural part of the frame or sash independently of the material used for waterproofing purposes. Non-inflammable material only shall be employed for the structural members used for retaining glass in the sash. Frames and sash shall be made of sheet metal or of rolled steel sections. Frames shall be of such form as to be retained in the wall opening either with flanges of at least one and one-half inches in width or by fixed anchors of proper length spaced not exceeding twenty-four inches securely set into the wall. Sheet metal frames and sash shall be made of galvanized iron of not less than No. 24 gauge and of a quality soft enough to permit of necessary bending without breaking, or of not less than 20-ounce copper, or other metal of equal strength and durability and which will not melt at a lower temperature than copper. All joints shall be made with interlocking seams, securely riveted together, and in no case shall solder be used for other than weather-proofing purposes. The head of the frame shall be closed at the top and the piece forming this closure shall be securely fastened to each side at all points. The sill shall be filled with concrete or other incombustible material. Movable or sliding sheet metal sash shall have stiles and rails of thickness and of width at least one and three-quarter inches respectively, and shall be securely fastened together at each corner and so constructed that they will correspond with the construction of the frames at every place of contact. Where frames are made of solid rolled steel sections the metal shall be not less than one-eighth inch in thickness securely riveted or locked together at all corners and junctions so as to possess sufficient strength and rigidity to withstand shipment, handling and installation without distortion. Where sashes are made of solid rolled steel sections the metal shall not be less than one-eighth inch in thickness excepting the removable members for retaining the glass and the weathering strips which shall not be less than one-sixteenth inch in thickness. The sash members shall be securely riveted or locked together at all corners and junctions so as to possess sufficient strength and rigidity to safely withstand the stresses occasioned by handling, installation, operation and by wind pressure. Frames and sash in the construction of which solid rolled steel section members are used shall have all their parts protected from the effects of rust and corrosion by a covering of durable enamel or by the application of two coats of approved mineral paint. All glazing of frames or sash shall be with wired glass at least one-quarter inch in thickness. The exposed area of any single pane or light of glass measured on the inner side of the window shall not exceed seven hundred and twenty (720) square inches nor shall the width or length of any pane or light of glass exceed forty-eight (48) inches. Glass shall be held in position by a metal ledge on each side of same. Ledges on the back or inner side of the glass shall be at

least three-quarter inches high for lights where the unsupported glass area is seven hundred and twenty (720) square inches and for glass of an unsupported area of less than seven hundred and twenty (720) square inches a reduction in height of the inside ledges may be made at the rate of one-sixteenth inch for each one hundred (100) square inches reduction of unsupported glass area, but in no case shall the height of the inside ledges be less than one-half inch. The ledges on the outer or weather side of the glass shall not be less than one-half inch in height for unsupported glass areas in excess of three hundred and fifty (350) square inches. For unsupported glass areas less than three hundred and fifty (350) square inches, the weather side ledge may be one-half the height of the inside ledge but in no case shall it be less than one-quarter inch high. Clearance between the edge of the glass and the bottom of the groove formed by the ledges shall not exceed one-eighth inch and all glass shall be set in suitable putty. Movable sash shall have stiles and rails so constructed that they will properly engage with the frame members at all points of contact, afford ample weather-proof qualities and not warp or bulge materially under heat or rapid cooling.

(d) Lifting or sliding sash shall be counter-weighted so as to balance and if double-hung the sash weights shall be separated by parting strips in the weight boxes and the weights shall be accessible through the boxes. Such sash shall be provided with metallic sash chain, cord or tape, and smooth running sash pulleys securely riveted or bolted in place. The sash chain, cord or tape shall be of sufficient strength to withstand severe heat without parting and be thoroughly protected against moisture or corrosion. Sash shall be fitted into frame with suitable stops and parting beads of metal or their equivalent. Sash shall be removable. Meeting rails of the sashes shall be so constructed as to prevent the passage of heat and flame and shall be equipped with one or more substantial sash locks securely riveted or bolted in place.

(e) Horizontally pivoted sash and movable sash shall be provided with steel pivots at least three-eighths inches in diameter securely attached above the middle. Pivots shall work in substantial iron or steel eye plates bushed with brass and securely attached in place. Sheet metal frames shall be reinforced where the pivots enter by riveting on one-eighth inch iron strips so drilled as to receive the pivots. Such sash must be provided with suitable stops and an effective attachment for holding them open or closed and with such substantial gravity locks or ledges that will be positive in action and hold the sashes tightly closed when exposed to heat. Where either sash is stationary or where two pivoted sashes are used the transom bar dividing such sash shall be so constructed that it will not warp or bulge materially under heat or rapid cooling. Rails or transom bars where used shall be made so as not to be easily affected by rust and to afford ample weatherproof qualities.

(f) Vertically pivoted sash shall comply generally with the requirements for horizontally pivoted sash and movable sash. They must be constructed in such a manner as to afford proper stiffness and so as to prevent material warping or bulging under heat or rapid cooling.

(g) Hinged sash or casement windows must be hinged with substantial iron or steel hinges securely bolted or riveted in place, and provided with substantial iron or steel latches or locks securely fastened in place. Such sash shall be constructed so as to fit the frame closely and afford ample weatherproof qualities at all points. It shall be provided with stops and fastenings that will prevent material warping or bulging under heat or rapid cooling.

(h) Where the area of wall openings is in excess of 5 feet by 9 feet, the metal frames containing the sash or glass must be reinforced at every point of division by not less than five-inch "I" beams securely fastened into the brickwork, proper allowance being made for expansion of the beams when heated. "I" beams shall be protected on the flanges with at least two inches of tile, concrete, or other material approved by the Commissioner of Buildings, and next to the web with at least two and one-half inches of such material, which thickness shall be increased on large beams. Metal frames shall be securely attached to the reinforcing members.

(i) Electro-glazed prism glass may be used in lieu of wired glass, when approved by the Commissioner of Buildings as to material and construction of same, providing the frames and sash of same comply with the requirements of this section for wired glass window frames and sash.

(j) In cases in which it is claimed that equally good or more desirable mode or manner of constructing and installing metal frames, metal sash and fire-resisting glass, other than specified in this chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings upon written application to him for a permit to use the same, shall cause a test to be made of such construction in a laboratory of recognized standing, and may appoint an architect or a fire prevention engineer to represent the City at such test. A requirement of testing said frame and sash shall be that it will be capable of withstanding exposure to fire on the weather side for one hour with temperatures rising gradually to at least fifteen hundred (1500) degrees Fahr. without loss of glass or material passage of flame, and immediately after exposure to such before-described fire conditions it shall be required to withstand application to the weather side of a stream of water at least seven-eighth inches in diameter applied from a distance of twenty feet at sixty (60) pounds pressure. The results of the test shall show also that the proposed material and construction will be equal or better in fire-resisting and structural qualities to a frame and sash of dimensions not greater than five feet by nine feet built as per requirements of this section. All expenses of this test shall be borne entirely by the applicant for such permit. In the event of such examination and test being satisfactory to the Commissioner of Buildings he shall authorize the use of such frames and sash as a compliance with this section.

(k) This section shall not apply to frame buildings nor to buildings outside the fire limits twenty-eight hundred square feet or less in area, nor to buildings of Class I, one story in height, nor to buildings of Class II not more than two stories in height, nor to store windows in the first story, where the same are located on an alley and not more than sixteen feet from the street.

785. **Window and Door Sills—Columns and Lintels Supporting Store Fronts—Incombustible.)** (a) For buildings other than frame buildings window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this Chapter, be counted incombustible.

(b) In buildings other than frame and excepting buildings of Classes III and VI, lintels shall be of incombustible material; provided that in one-story store front buildings columns and lintels may be of combustible material.

786. **Courts and Light Shafts in Buildings.)** (a) Every court or light shaft of every building shall be open and unobstructed from the bottom of such court to

the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

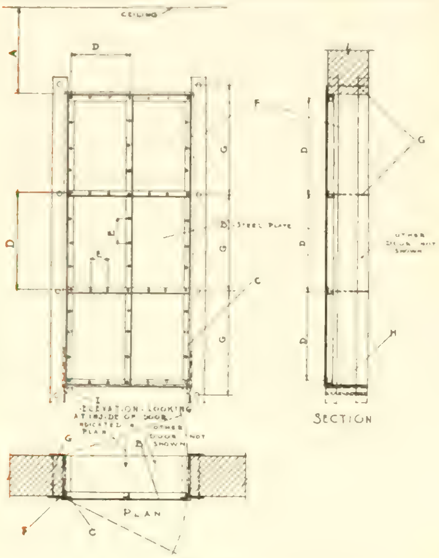


Fig. 28.

DIVIDING WALLS AND IRON DOORS—OPENINGS INSERTED.

Section 789c, f.

(A) Distance to ceiling.

If A is less than 3′ 0″ fusible link at ceiling may be omitted.

(B) Steel plate, No. 12 U. S. gauge or greater.

(C) Continuous 2″ x 2″ x ⅜″ Ls.

(D) 2 x 2 x ⅜″ Ls forming panels. Angles not less than 2′ 0″ apart.

(E) Rivets spaced from 4″ to 6″ o. c.

(F) Door frames 3 x 4 x ⅜″ Ls (or alternate as by ordinance).

(G) ¾″ bolts, not more than 2′ 0″ o. c. fastening frame to wall.

(H) ¼″ iron or steel sill required.

(I) Sill fastened to frame by 1½ x 1½ x ¼″ Ls on inner side of frame.(Sec. 789f).

Exception: Sill plates may be omitted where floors are of concrete construction.

(b) All windows, doors or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors, with the glazed portions thereof of wired glass.

787. **Bay Windows—Light Courts—Shafts—Construction of.)** (a) The walls of every bay window and every court in every masonry constructed building, except buildings of Class III, shall be built of brick or other fireproof construction throughout as required for exterior walls.

(b) The walls of every vent shaft of every masonry constructed building, except buildings of Class III, shall be built of masonry or a fireproof material not less than four inches in thickness supported by steel or iron.

(c) Every court, light shaft, or vent shaft in every building shall be open and unobstructed from the bottom of such court to the sky with the exception that fire escapes may be built in courts or light shafts, subject to all the provisions of this Chapter.

(d) All windows, doors, or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors with the glazed portion thereof of wired glass.

788. **Windows, Cleaning of—Safety Devices.)** The owner or agent of every building in the city shall equip each and every window in any such building above the first story thereof with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building above the first story without danger to the person cleaning such windows, and such devices shall be of such pattern and construction as will reasonably and safely answer the purposes for which they are intended; provided, however, that if windows are of such construction that they may be easily cleaned from the inside they need not be equipped with such devices.

(See Illustration, Sec. 740b).

789. **Dividing Walls and Iron Doors—Openings Inserted.)** (a) Wherever openings are to be inserted in dividing walls in buildings, where such dividing walls are required by reason of the large area of such building, or in dividing walls between two or more connected or attached buildings, they shall be provided with incombustible doors as follows:

(b) Such doors may be either sliding doors or swinging doors, and shall be so constructed, installed and maintained that they can be easily opened or closed from either side at all times by any person; provided, however, rolling steel shutters may be used when such openings are not used as exits.

(c) Every such door shall be equipped with a device containing a fusible link or other releasing arrangement of equal efficiency, approved by the Commissioner of Buildings. There shall be one of these immediately above the door opening and one above the opening near the ceiling. Where the ceiling is less than three feet above the door opening, the last mentioned fusible link or releasing device may be omitted, if the doors are so arranged that the operation of any one of the thermostats, or other releasing devices, will result in the closing of the doors on both sides of the walls. Fusible links, or other approved substitute, shall be made so that they will fuse or operate when subjected to a heat of 160 to 165 degrees Fahrenheit. If said doors are of steel plate, the plate or plates shall be of No. 12 U. S. gauge or greater thickness, with a continuous two by two by three-eighths inch angle iron frame extending all around the same and two by two by three-eighths inch panel bars not exceeding twenty-four inches apart, riveted to the plate of the door with not less than three-eighths inch rivets spaced four inches to six inches between centers. Pairs of swinging doors shall be so constructed that when the doors are closed, they will be of strength equal to that of a single door, and shall be so arranged that they will operate automatically. All doors shall be hung on wall frames of four by three by three-eighths inch angle iron or of four by three-eighths inch bar iron stiffened by one and one-half by one and one-half by one-fourth inch angles riveted on the back and fitting snugly to the wall. The frame shall be fastened together by three-fourths inch bolts extending through the wall, such bolts being not more than two feet apart. All doors to be made to fit closely to the wall frame on all sides. Lintels of door openings shall be made of brick, iron or concrete.

(d) Swinging iron doors shall swing on three wrought iron hinges made of two by three-eighths inch bar iron and shall be secured by at least three lever bars of one and one-half by three-eighths inch iron, working together and so arranged as to be operated on either side of the door.

(e) Sliding iron doors shall slide in channels at the top and bottom; bottom channels shall be formed by two angles two and one-half by three-eighths inch and one and one-half by one-fourth inch; top channels to be formed by two angles two by

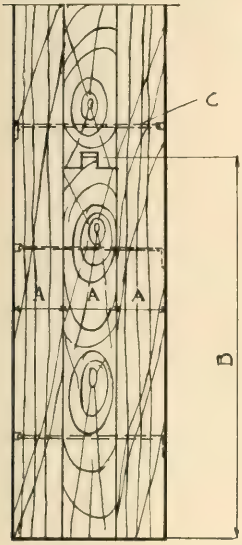


Fig. 29. **Fig. 30.** **Fig. 31.**

DIVIDING WALLS AND IRON DOORS—OPENINGS INSERTED—(Continued).

Section 789j.

Fig. 29. Tin-clad Doors.
(A) Three thicknesses of 13/16" required.
(B) Boards not wider than 8". Outside layers vertical and inside layer horizontal laid.
(C) Nails clinched as (C).

Fig. 30. Single locked tin plate seam.

Fig. 31. Double locked tin plate seam.

three-eighths inch and one and one-half by one-fourth inch; channels shall be securely riveted or bolted through the wall frame and where they extend beyond the wall frame shall be firmly bolted to the wall by expansion bolts. Track shall be without incline, of one-half by one-half inch iron securely riveted on the upper side of the angle iron channel. Hangers shall be of the anti-friction pattern and securely fastened to the door plate by at least four one-half inch bolts. Wheels shall be of cast iron three-fourths by four and one-half inches.

(f) Sills between iron doors shall be of one-fourth inch iron or steel with edges securely fastened to one and one-half by one and one-half by one-fourth inch angle iron or heavier, on the inner side of the wall frame. Where adjoining floors are of concrete construction, sill plates may be omitted.

(g) When tin-clad doors are used they shall be made of three thicknesses of thirteen-sixteenths inch seasoned, non-resinous wood, of good sound quality, free from sap and large or loose knots, tongued and grooved, dressed on both sides and not exceeding eight inches in width. The outside layers shall be vertical, the inside layer shall be horizontal; layers shall be securely fastened together by wrought iron clinch nails driven in flush and clinched so as to leave smooth surfaces. The woodwork shall be thoroughly covered with terne plate tin of size fourteen by twenty inches, weighing not less than one hundred and thirteen pounds per box of one hundred and twelve sheets; all joints shall be locked one-half inch and nailed under seams, except on edges of door; vertical joints shall be double locked, horizontal joints single locked.

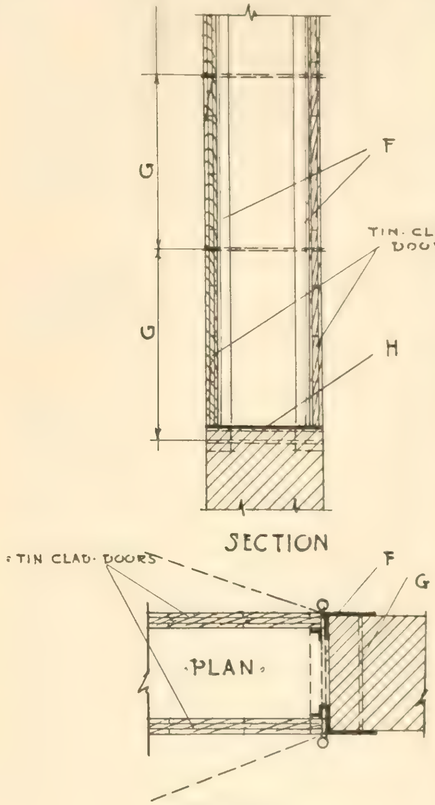


Fig. 32.

Section 789g.

Fig. 32. (H) ¼ inch iron or steel sill.
(F) 3" x 5" x 3/8" L riveted to iron sill.
(G) ¾ inch bolt 18" o. c.
Exception: Sill plates may be omitted where floors are of concrete construction.

Nails used to fasten tin shall be No. 13 gauge, flat head, full barbed wire, two inches long.

(h) Swinging tin-clad doors shall have three-eighths by two and one-half inch wrought iron hinges bolted to doors with four three-eighth inch bolts. Doors in excess of seven feet in height shall be provided with three hinges and have wrought iron wall eyes built in wall, or riveted to wall frame, or bolted through wall with three-fourth inch bolts. They shall have at least three level bars of one and one-half by three-eighths inch iron, working together; the latch shall be placed so it can be operated from either side of the door and provided with proper keepers bolted through the door, with the spring to insure latching; catches shall be made of one-half inch wrought iron securely bolted to wall or wall frame.

(i) Sliding tin-clad doors shall have tracks inclined three-fourths inch to the foot, made of three and one-half by three-eights iron rolled steel, or round bars, or round pipes of equal strength, securely bolted through wall with three-fourths inch

bolts. Hangers shall be made of three-eighths by three and one-half inch wrought iron attached by not less than one-inch bolts. Wheels shall be of malleable or wrought iron with not less than one and one-half inches bearing on axle. Doors over six feet wide shall have three hangers and shall be provided with necessary binders, chafing strips, bumpers and bumper shoes.

(j) Sills between tin-clad doors shall be of one-fourth inch iron or steel riveted to a three and one-half by five by three-eighths inch angle iron on each side of the wall; angle irons to be fastened together through the wall by three-fourths inch bolts spaced not to exceed eighteen inches apart; provided, that where adjoining floors are of concrete construction, sill plates may be omitted.

(k) Rolling steel doors used as dividing wall doors shall be made either of wooden slats covered with steel or bronze, or of number 20 U. S. gauge painted steel, or of number 24 U. S. gauge galvanized steel. The edges of such doors shall run in steel channels not less than one and one-half inches deep, and three-sixteenths of an inch in thickness.

(l) Such doors shall be hung on winding shafts and helical springs of sufficient strength to counterbalance the door at any position, and shall be equipped with a device to hold the doors in a closed position if the spring is destroyed. The head of the door opening shall have baffle plates of number 12 U. S. gauge steel, which shall be reinforced around the edges by one and one-half inch angles, to act as fire and smoke stops. The openings for such doors shall have steel frames and sills as herein required for steel swinging doors.

(m) Wherever incombustible doors are to be used in openings to vertical shafts for stairways, passenger and freight elevators, pipes, conduits, and in corridor and room partitions, they may be made of two thicknesses of wood and covered with tin as described in paragraph (g) of this section, or of No. 20 U. S. gauge steel with stiles and rails not less than one and three-fourths inch and panels one-quarter inch thick, and the interior of said doors shall be filled with asbestos or non-resinous wood; provided however, that in fireproof buildings of Classes IIa, IIb, III, except when used in part as a stable and garage, IV, VI, and VIII, and in fireproof buildings of Class I, when equipped with an automatic sprinkler system, and when the occupancy does not constitute a special fire hazard in the opinion of the Chief of Fire Prevention and Public Safety, these openings, with the exception of openings to freight elevators, may be provided with incombustible doors consisting of a structure of clear, non-resinous wood not less than one and five-eighths inch thick assembled in the form of a core and protected on all surfaces with a pure long fibre asbestos fabric, weighing one and twenty-eight one-hundredths ounces per square foot, or other protective coating equally as incombustible and mechanically bonded therewith and veneered, or consisting of a structure of clear, non-resinous wood with panels not less than three-quarters inch thick and stiles and rails not less than one and five-eighths inch thick assembled in the form of a core and covered on all surfaces with an asbestos fabric and sheet steel, copper or bronze; provided, further, that nothing contained in this paragraph shall be construed as prohibiting the use of such incombustible doors as are described in paragraphs (c), (g) and (k) of this section and paragraph (b) of Section 784. The frames and trim shall be of materials as herein described.

(n) No glass panels shall be permitted in incombustible doors, except that in fireproof buildings of Classes I, IIa, IIb, III except when used in part as a stable or garage, IV, VI and VIII, doors to passenger elevators, stairs, halls, courts, fire escapes, corridor and room partitions, wired glass panels may be used not exceeding one thousand four hundred forty square inches in total area, no division of which shall exceed 720 square inches in area and no dimension of which shall exceed forty-eight inches in extent. Where an elevator or stairway is enclosed with incombustible partitions and doors for the purpose of obtaining credit for additional exits, no glass of any kind shall be permitted in these partitions or doors.

790. **Metal or Reinforced Concrete Chimneys in Fireproof Buildings—Air Space.)** (a) Internal chimneys of rolled steel or iron may be built in buildings of fireproof construction, provided that the rolled steel shall be not less than three-eighths inch in thickness, except that the upper fifty feet of such chimney may be one-quarter of an inch in thickness, riveted in every joint, or of cast iron, providing same shall not be less than three-fourths inch in thickness and jointed by bell and spigot joints or flanged bolted joints. All joints in cast iron work shall be filled and pointed with fire clay. Such metal internal chimneys shall be securely and firmly anchored to the framing of such fireproof building at each floor line and at the roof. The lower part of each such chimney shall be lined with insulating lining for a height herein required for the respective area by Section 794 of this Chapter. The insulating lining shall be one of the linings described in Section 796 of this Chapter.

(b) Reinforced concrete not less than four inches in thickness may be used on the interior of fireproof buildings, provided the requirements for reinforced concrete and for reinforced concrete stacks elsewhere required by this Chapter shall be complied with.

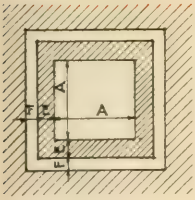
(c) Internal metal or re-inforced concrete stacks on fireproof buildings shall be surrounded by continuous air space from the lowest story through the roof not less than four inches across at any point, and said air space shall be surrounded by brick, hollow tile, or reinforced concrete. No structural metal in such air space shall be without such fireproof covering.

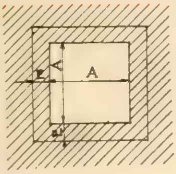
791. **Reinforced Concrete Chimneys — How Built.)** Reinforced concrete chimneys in which the temperature of the gases is intended to exceed 750 degrees Fahrenheit, shall be lined with fire brick or magnesia or asbestos insulating lining for the height and in the manner elsewhere required by this Chapter. If the insulating is stopped anywhere below the top of a reinforced concrete chimney or if the cross section of such a chimney is changed, then the reinforcing shall be increased at such points sufficiently to prevent the formation of temperature cracks.

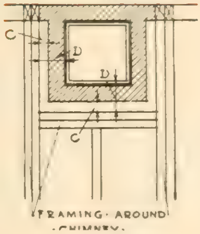
792. **Tenement and Apartment House Boiler Chimneys.)** Chimneys for the heating apparatus of tenement and apartment houses shall not be considered as flues used for domestic purposes.

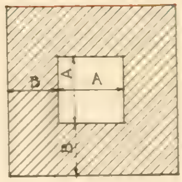
793. **Height of Chimneys Above Roof.)** (a) The height of all chimneys and flues of stoves used for domestic purposes or open fireplaces shall be not less than five feet higher than the highest point of the roof of the building of which they are a part.

(b) The height of all chimneys and flues above the highest portion of the roof of which they are a part, where such chimneys or flues are used for other than domestic purposes or for open fireplaces, shall be determined by dividing the greatest diameter in inches by four, and the quotient thereby obtained in terms of feet, with five feet added, shall be the minimum height from the tops of such chimneys and flues above









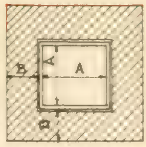


Fig. 33. **Fig. 34.** **Fig. 35.** **Fig. 36.** **Fig. 37.**

CHIMNEYS—INSULATING CAVITIES WHERE REQUIRED.
Section 794.

Figs. 33, 34 (A) Area of flue.
(E) Insulating lining.
(F) Insulating cavity.

Explanation: If A is more than 400 sq. in. an insulating lining (E) is required=(see Sec. 797 for further defails). If A is more than 400 sq. in. the walls surrounding shall have an insulating cavity F not less than 3″ wide.

If E in Fig. 34 is of fire brick of 4″ or more in thickness it may be considered as a portion of thickness required for walls surrounding.

Section 797, Framing Around Chimneys.

Fig. 35. (C) Is distance joists or timbers are to be kept away from wals of chimneys = 2″.

(D) Is distance to be kept away from inside of flue lining = 7″.

Section 800. Walls Forming Smoke Flues.

Fig. 36. Shows chimney without flue lining.
If A = 144 or less. B = 8″.
If A = more than 144 and not more than 600. B = 12″.
If A = more than 600. B = 16″.
For exceptions see ordinance, Sec. 800.

Fig. 37. Shows Chimney with flue lining, not less than ¾″ thickness.

If A is 144 sq. in. or less, walls surrounding may be (B) or 4″.

If A is more than 144 sq. in. and not more than 300 sq. in. B = 9″.

If A is more than 300 and not more than 600. B = 12″.

If A is greater than 600. B = 16″ (exceptions and reductions being stated in Sec. 800).

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the highest portion of roof of the building. In no case shall the height of any chimney or flue be less than five feet above the roof of the building of which it is a part.

(c) Where a wooden tank, pent house or roof house is on the same building with a chimney, the required height of any such chimney above the roof of the building shall be not less than two-thirds of the sum of the horizontal distance between the chimney and such tank, pent house or roof house added to the vertical distance between the top of such tank, pent house, or roof house and a horizontal plane through the top of the chimney. The tops of chimneys within a radius of twenty-five feet of any wood tank, pent house, or roof house, on the same building of which such chimney shall be a part shall be at least as high as the top of said wood tank, pent house, or roof house. The tops of chimneys on ridge roofs shall be not less than three feet above the ridge.

794. **Insulating Cavities — Where Required.)** All flues having a greater area than four hundred square inches shall be lined on the inside with an insulating material, which lining shall start at least two feet below the smoke inlet and shall extend upwards for at least ten times the diameter of the flue, or if said flue is not circular or square in cross section for ten times the average diameter, when the flues are of brick, stone or concrete, said insulating lining shall be fire clay brick or fire clay blocks, and if such bricks or blocks are four inches or more in thickness, they may be considered as a portion of the thickness required for the surrounding walls. The walls surrounding chimneys having an area greater than four hundred square inches shall have an insulating cavity not less than three inches wide surrounding the inner four inches of fire brick or fire clay blocks, for not less than the height required above for insulating lining and said inner core shall be built independent of the surrounding brick work and shall be free to expand or contract.

795. **Metal Chimneys in Buildings of Ordinary Slow-Burning or Mill Construction.)** Interior stacks or smoke flues of metal shall not be used in buildings of ordinary or slow burning or mill construction, unless they are surrounded by self-supporting brick or re-inforced concrete walls of the thickness herein required for flues of the respective area; provided, however, that if an interior smoke pipe of steel of not less than three-eighths inch in thickness riveted in every joint, or an interior smoke pipe of cast iron not less than five-eighths inch in thickness is used, then the brick work required inside of the insulating cavity of a stack may be omitted, but such metal linings shall be lined with such insulating material for the height herein elsewhere required for stacks. If a chimney or stack is not a part of the walls of such a building, it shall be designed as an isolated chimney as required by Section 799 of this Chapter.

796. **Insulating Material for Metal Chimneys and Metal Stacks.)** (a) Fire clay brick or fire clay blocks may be used for the insulating lining of metal chimneys and stacks but not of a lesser thickness than two inches. The material shall be increased in thickness or supported on structural steel ledges and the material shall be stressed not to exceed the safe limits of stress elsewhere herein fixed for the material, or metal chimneys and metal stacks may be lined with blocks of magnesia insulation or with fused asbestos board insulation, or metal stacks or chimneys may be lined with any other insulating material tested and approved by the Commissioner of Buildings.

(b) Magnesia block insulation shall contain not less than 45 per cent of magnesia and 50 per cent asbestos fibre formed into blocks not less than 1½ inches in thickness by hydraulic pressure. After said magnesia blocks have been set, they and all metal bands and ties exposed with the flue shall be plastered with cement not less than one-half inch in thickness on one and one-half inch blocks, and one-fourth inch in thickness on one and three-fourths inch and thicker blocks.

(c) Fused asbestos board shall be made of alternate flat and corrugated sheets of asbestos board, cemented together and fused

under a heat of not less than 1,000 degrees Fahrenheit to a minimum thickness of 1¼ inches. After said fused asbestos boards have been set into the flues, they and all exposed metal bands or ties shall be pointed with cement.

(d) Such magnesia blocks, fused asbestos boards, pointing cement and any other insulating material approved by the Commissioner of Buildings shall resist the disintegrating, dissolving, or diminishing action of moist steam and the acid and gaseous fumes present in the flue at any degree of heat obtainable by the combustion of the fuel used.

797. **Chimneys — Interior — Framing Around.)** In case of chimneys which are enclosed, or form part of the interior of any building, no joists or girders shall rest or be supported on the walls of such chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

798. **Chimneys — External Location of.)** (a) Chimneys built outside of the walls of buildings shall not encroach upon any street or alley, and shall be built as follows:

(b) If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick, extending to a height of at least ten feet above the street or alley grade.

799. **Chimneys—Isolated—Walls Surrounding Smoke Flues.)** Isolated chimneys shall be so designed and constructed that the stress in every part thereof, due to the weight of the chimney itself and from wind pressure, shall not exceed the safe limits as provided in this Chapter for the material used.

800. **Walls Forming Smoke Flues.)** The walls forming smoke flues of one hundred and forty-four square inches area or less shall be of brick, concrete, stone, or of any one of these and burnt fire-clay flue tile lining, and such flue linings shall extend from the lowest opening to a distance of at least two feet above the roof joints. If only one of the above materials is used it shall not be less than eight inches in thickness. Provided, however, that such flues having walls at least three inches in thickness of continuous concrete or interlocking or rabbited joint concrete sectional flues may be used without burnt fire-clay flue tile linings. If any one of the above materials is used in combination with burnt fire-clay tile flue lining it shall be not less than four inches in thickness, and the burnt fire-clay flue lining shall be not less than three-fourths inches in thickness, and built as herein described. The walls forming smoke flues of more than one hundred and forty-four square inches area and not more than three hundred square inches area shall be of brick, concrete, stone, or any one of these and burnt fire-clay flue tile lining. If any of the above materials is used alone, it shall be not less than thirteen inches in thickness. If any one is used in combination with burnt clay flue tile lining, it shall be not less than nine inches in thickness and the fire-clay flue tile lining shall be not less than three-fourths inch in thickness and built as herein required. The walls forming flues having an area greater than three hundred square inches and less than six hundred square inches shall be built of one of the materials described above not less than twelve inches in thickness, and flues having an area greater than six hundred square inches shall have walls of one of the materials described above not less than sixteen inches in thickness, and these walls may be reduced to twelve inches in thickness at a point not less than fifty feet above the top of the breeching; provided, however, that the material of which all chimneys are constructed shall be so proportioned that it will not be subjected to a greater stress than elsewhere herein fixed as the maximum safe stress for such material.

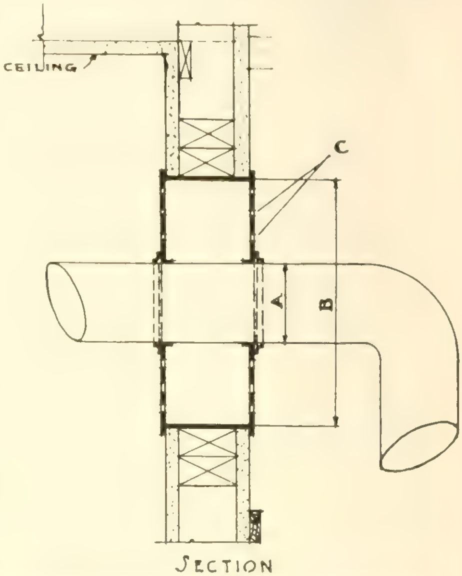


Fig. 38.

SMOKE PIPES PASSING THROUGH PARTITIONS AND WOOD WORK AROUND.

Section 802.

(A) Diameter of smoke pipe, 6″ or less.
(B) Diameter of thimble required 8″ greater than diameter of smoke pipe.
(C) Ventilation holes required.

801. **Ventilating Ducts — Chutes — Walls Forming.)** Walls forming ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls forming ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than two hundred and sixty square inches the walls shall be not less than eight inches thick.

802. **Smoke Pipes Passing Through Partitions.)** In buildings hereafter erected it shall be unlawful to allow smoke pipes of greater diameter than six inches to pass through a combustible partition. Where a smoke pipe of six inches or less passes through a combustible partition it shall be surrounded by a ventilated thimble of incombustible material or by incombustible material with a diameter at least eight inches greater than the diameter of the pipe.

803. **Boilers — Location of — Permit for.)** In all cases, boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers. The size, number and location of boilers to be installed in any building shall be marked on the plans and, except in buildings of Class III, approved

by the Department for the inspection of Steam Boilers and Steam Plants, and by the Department of Health before a permit is issued by the Department of Buildings for the erection of such building.

804. **Foundry Cupolas — Construction of Charging Floors and Roofs—Height Above Roof.)** There shall be no combustible material used in the construction of a charging floor or a roof within thirty-six inches of the foundry cupola. Where the charging floor is less than eight feet above the dump floor no combustible material whatever shall be used in the construction of such charging floor. Foundry cupolas shall extend twenty-five feet above the highest point of any roof within a radius of forty feet from such cupola, unless such roof is of metal or fireproof construction.

805. **Cornices — Eaves — Gutters — Pipes from Roof.)** (a) No wood shall be used for any purpose in connection with cornices, eaves and external gutters on any building more than fifty feet in height. The entire exterior covering of cornices and eaves of buildings hereafter to be erected within the fire limits shall be of incombustible material.

(b) Wherever sheet metal cornices or eaves or external gutters are used, their entire exterior covering shall be of metal or other incombustible material approved by the Commissioner of Buildings. Bracket supports for same shall be firmly secured to the wall at least every four feet, and the walls shall be carried full height under and behind same throughout their entire length.

(c) The water from all roofs shall be carried to the sewer in metal conductor pipes. Every such conductor shall be continually maintained in good condition, and if such conductors are within the exterior walls, they shall be of screwed-joint iron or steel pipe, or of cast iron pipe with calked joints.

806. **Towers, Domes and Spires—Construction of.)** Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-quarter of the street frontage of any building. Such towers, domes, or spires, if any part thereof is built to a height of more than fifty feet and less than ninety feet, shall be of slow-burning construction, and, if of a greater height then ninety feet above the sidewalk, shall be of fireproof construction; and, in all cases where the area of such tower, dome, or spire exceeds one hundred square feet, its supports shall be carried down to the ground, and if the structure supported is more than fifty feet and less than ninety feet high, it shall be of slow-burning construction, and, if more than ninety feet high, of fireproof construction. No tower, dome, or spire shall exceed thirty-six hundred (3,600) square feet in area, and in no case shall the area exceed fifteen per cent of the total area of the building on which it is erected, nor shall the height of any tower, dome or spire exceed four hundred feet measured from the established inside grade.

807. **Structures—Construction and Limitations of.)** All structures built within the City other than those otherwise specifically provided for herein shall be designed and constructed according to established engineering practice, and shall comply with the provisions of this section. No structure of frame or mill construction within the fire limits shall exceed 35 feet in height from the ground to the highest point thereof. No structure of mill or frame construction outside the fire limits shall exceed the height of 45 feet from the ground to the highest point thereof.

All structures over thirty-five feet in height within the fire limits, and all structures over forty-five feet in height outside the fire limits shall be built of structural steel, concrete or masonry; provided, however, that viaducts or runways to be used for the purpose of transferring livestock from one building or place to another may be built of wood not to exceed eighty feet in height either within or without the fire limits.

If it is desired to enclose any structure, such structure shall be enclosed with concrete or masonry walls, or incombustible material of such construction as shall be approved by the Commissioner of Buildings; provided that structures outside the fire limits not exceeding 2,800 square feet in area, or 45 feet in height, may be enclosed with combustible material.

In every structure contemplated by this section safe and adequate means of ingress and egress shall be provided for persons employed in and about the same.

All structures whose height exceeds twice their least dimensions at their base shall be so designed as to safely resist a wind pressure of 30 pounds per square foot of surface exposed to the action of the wind.

808. **Skylights—Construction of—Glass in.)** (a) Any skylight on the roof of any building less than ninety feet in height, other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood, metal clad on all exterior surfaces. Any skylight on a building more than ninety feet in height shall be entirely of incombustible material.

(b) Every skylight shall be provided with ventilation opening of an area of at least three per cent of the base area of the skylight.

(c) The glass in all such skylights, except in buildings in Classes III and VI, not exceeding three stories in height, shall have at least six inches over same a strong wire netting with wire not lighter than number twelve gauge, galvanized after weaving, and mesh not coarser than one by one inch, unless the glass contains a wire netting within itself. Supports for screen shall not be less in size than the bars supported and of the same material.

809. **Inclosures upon roof.)** Skylights, inclosures for water tanks and inclosures for elevator machinery, the construction of all of which inclosures shall be entirely of incombustible material, shall be permitted to be erected on the roofs of all buildings more than fifty feet and less than one hundred feet high; provided, however, that the roofs of same may be built of mill or slow-burning construction.

810. **Roof — Construction of — Pitch of.)** Buildings, other than frame buildings when permitted by this Chapter, less than fifty feet in height with roofs which have a slope of more than three inches per horizontal foot, shall have the roofs covered with incombustible material. Buildings more than fifty feet and less than one hundred feet in height with roofs which have a slope greater than three inches per horizontal foot and which are of timber construction, shall have such roofs covered with an incombustile covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards or other incombustible material, which shall be at least two inches thick. Where this covering is placed upon the roof boards wooden strips shall be inserted, which shall be securely fastened to the wooden structure at regular intervals between the incombustible covering and a weatherproof covering of incombustible material.

811. **Roofs—Shingle or Gravel.)** (a) The use of shingles or other forms of combustible roof covering on buildings erected or altered otherwise than is provided in Section 871, within the fire limits, is prohibited, except as hereinafter provided. In existing

frame buildings not more than three stories high, the shingle roofs may be repaired with shingles or other materials.

(b) Roofs, the slope of which is not more than three inches per foot horizontal, and the covering of which is made of a composition of felt and gravel, shall be considered incombustible under the provisions of this Chapter, and may be used upon buildings of all classes. Other forms of composition roof shall be permitted if expressly approved as an incombustible roof by the Commissioner of Buildings.

812. **Buildings—Height of—Parapet Walls—Roof Houses—Housing Tanks—Skylights and Scuttles.)** (a) The limits of heights of buildings heretofore given for non-fireproof buildings shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the roof thereof. Where such street grade varies, the mean or average grade thereof opposite the building shall be the data from which such height is measured.

(b) The height of a fireproof building shall be the perpendicular distance from the inside sidewalk grade of the street nearest the building to the highest point of the external bearing walls. Where such street grade varies, the mean or average grade thereof opposite the building shall be the data from which such height is measured.

(c) No building shall be erected in the City of greater height than two hundred sixty feet. The erection of parapet walls or of balustrades constructed entirely of incombustible material shall be permitted above the roof level of buildings of all classes, in addition to the height fixed herein for the same.

(d) Roof houses for elevators, tanks, skylights, stairs or scuttles may be built above the height of the main roof.

813. **Basement — Defined.)** The upper surface of the floor of the first story of buildings of every class excepting Classes VI and VIII shall be not more than ten feet three inches above the inside sidewalk grade of the street nearest the building and that portion of the building below said floor shall be designated as the basement of the building of which it is a part.

Note: See Section 634 (h).

814. **Sub-basements and Cellars — Construction of.)** (a) No building shall have more than one basement or cellar of ordinary or slow-burning or mill construction; all additional basements or cellars shall be of fireproof construction as described in this Chapter, the elevator enclosures shall be of brick from the lowest basement floor level to the first story floor, and the stairways shall be inclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outwards.

(b) In cases where a pipe, conduit, dumbwaiter, cable, wire, conveyor or belt, or any combination thereof, passes through a floor from one basement to another, the opening in the floor shall be inclosed as specified in this Chapter.

(c) The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

815. **Concrete Floors in Basements — Requirements.)** Wherever concrete floors are laid in basements of buildings now in existence or buildings hereafter to be erected, the concrete of such floors shall be at least three (3) inches in thickness and such floors shall be laid on a sand or cinder foundation not less than six (6) inches in thickness.

816. **Canopy — Plans Must be Approved Before Permits Issue—Fee for Permit—No Advertising Matter or Obstructions Permitted.)** It shall be unlawful for any person, firm or corporation to erect or construct any canopy attached to a building or structure under any general or special ordinance now in force or which shall or may hereafter be adopted without first submitting the plans of such canopy, and also of the part of the building or other structure to which it is to be attached, to the Commissioner of Buildings for his approval. No permit shall be issued by the Department of Public Works unless the plans of such canopy shall be approved by the Department of Buildings and a permit to attach said canopy to the building from which it is intended to project shall be obtained from the Commissioner of Buildings. The owner or agent shall pay to the Department of Buildings a fee of ten dollars for said building permit. No canopy that has been or may hereafter be authorized by any general or special ordinance, which projects over any street or other public place shall at any time be enclosed by canvas or other cloth or material in whole or in part so as to obstruct free passage underneath same, nor shall any such canopy be equipped with or have attached thereto any illuminated or other signs, transparencies, placards, streamers or other advertising devices of any kind; and in case any such canopy shall at any time contain such advertising matter or device it shall be the duty of the owner, lessee or person in charge or control of such canopy, upon notice from the Mayor, to forthwith remove such advertising matter or device.

817. **Canopies and Marquees—Annual Inspection Fee.)** The Commissioner of Buildings shall make an annual inspection of canopies and marquees attached to buildings or other structures which shall extend into or over any street, alley or any public place, and for such inspection shall make the following charge:

Where the horizontal projection of the canopy or marquee does not exceed 200 square feet in area the annual inspection fee shall be five dollars; and where the horizontal projection of the canopy or marquee exceeds 200 square feet in area the fee shall be five dollars for the first 200 square feet and one dollar additional for each additional 50 square feet in the area of such canopy or marquee.

818. **Scaffolds—Protection During Building Operations—Temporary Floors.)** (a) All scaffolds erected in this city for use in the erection, repair, alteration, or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of persons working thereon or passing under or by the same; and to prevent the falling thereof, or the falling therefrom of any material that may be used, placed or deposited thereon.

(b) It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction of or remodeling of any building having more than three framed floors, whether some or all of such floors are above the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a plank floor, which shall be laid to form a good and substantial temporary floor for the protection of the employes and all persons engaged above or below or on such temporary floor in such building.

(c) Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

(d) A good and substantial temporary floor shall be laid on the joists or girders of the next lower floor where the temporary or permanent floor of the second story or the floor or floors above the second story or

roof is being placed previous to the placing of the permanent floor or floors immediately below the floor which is being arched or planked. The lowest framed floor in a building shall be considered the first floor.

(e) In buildings more than three stories high where persons are working on a scaffold or scaffolds on the outside of such building such persons shall be protected by well secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

the construction of such building may be revoked in the discretion of the Commissioner of Buildings where such violation occurs.

819. **Wood Lathing and Plastering.)** (a) In all buildings of frame or of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with the following specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a

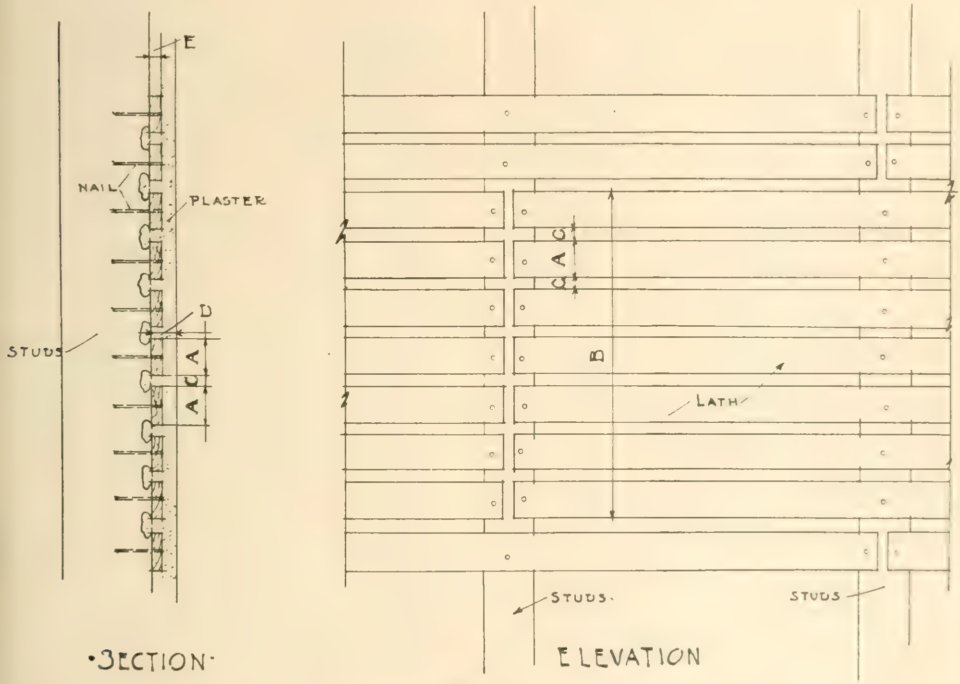


Fig. 39.

WOOD LATH AND PLASTERING.
Section 819.

(A) Lath to be 1½" wide.
(B) Break joints of lath every seventh lath.
(C) Spacing of lath not to be less than ¼" apart.
(Exception Class I—⅜" spacing allowed—see Sec. 819b).
(D) Plaster coating to finish ⅞" thick.
(Exception Class I—¾" thick finish—see Sec. 819b).

(f) It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected, and it shall be their further duty to comply with an act of the Legislature of the State of Illinois, entitled "An act providing for the protection and safety of persons in or about the construction, repairing, alteration or removal of buildings, bridges, viaducts and other structures, and to provide for the enforcement thereof," approved June 3, 1907, and in force July 1, 1907.

(g) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for

break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of frame or of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms, not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed. Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in

the room used for the purpose of Class I; and provided further, that where such building of frame or of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal-plates are applied on walls of buildings of frame or of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this section for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

(d) Wallboard or plasterboard of gypsum, asbestos, or other approved incombustible material, containing not more than four per cent (4%) by volume of paper or other combustible fabric reinforcement may be used as a substitute for wood lath where the use of wood lath is permitted by the provisions of this chapter in buildings of frame or of ordinary construction. When such wallboard or plasterboard is attached to metal studding or metal furring and is used as a base for two coats of plaster or mortar, the wallboard or plasterboard and plastering finishing to not less than seven-eighths of an inch in thickness in ceilings and in hollow partitions and not less than two inches in thickness in solid partitions, it may be used in this manner in such buildings and under such conditions as follows:

In buildings of slow burning and mill construction for partitions other than corridor partitions and other than enclosing partitions around stairways, elevators, shafts or other floor openings.

In buildings of fireproof construction of Class II, Class III and Class VI for suspended or false ceilings below a fireproof floor system or roof system built in accordance with the provisions of this chapter and for partitions other than corridor partitions and other than enclosing partitions around stairways, elevators, shafts or other floor openings. The ingredients and the proportions thereof for mortar and plaster and the manner of mixing and preparing same for plastering, as used in accordance with the requirements of this section, shall be subject to the approval of the Commissioner of Buildings.

820. **Sidewalk and Street—Occupation of —Limitations.)** (a) The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building, shall be as follows:

(b) Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

(c). During the progress of building operations, a sidewalk not less than six feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

821. **Sidewalk—Delivery of Material—Elevated Sidewalks.)** It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street, and in case a sidewalk is so elevated it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

822. **Temporary Roof Over Sidewalk—Time Maintained.)** When buildings are erected of a height greater than four stories and such buildings are near the street line, there shall be built over the adjoining sidewalk a roof having a framework composed of supports and stringers of three by twelve timbers not more than four feet from center to center, covered by two layers of two-inch plank. When additional stories are added to an existing building and such building is located near the street line, there shall be built over the sidewalk, at the point where the new stories commence, a scaffold not less than six feet wide, which shall form a covering over the sidewalk composed of a framework of stringers and supports, covered by two layers of two-inch planks. Such framework and covering shall be of such construction and design as shall be satisfactory to the Commissioner of Buildings. Such roof shall be maintained as long as material is being used or handled on such street front above the level of the sidewalk. Temporary sidewalks, their railings, approaches and roofs over same, shall be made with regard to ease of approach, strength, and safety, to the satisfaction of the Commissioner of Buildings.

823. **Storage of Building Materials—Limitations.)** The occupation of the street for the storage of building material for any one building or for temporary sidewalks, shall never exceed one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any steam or street railway track, and in all cases where such obstruction of the street is made there shall be a clear space of not less than one foot between such obstruction and the curb line. Provided, that the Commissioner of Buildings and the Commissioner of Public Works, or either of them, may limit, or entirely restrict, the storage of material on any street or alley where a tunnel, conduit, or any underground passageway or subway is located.

824. **Sidewalks and Street—Excavated Material and Rubbish On—How Cared for.)** Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings

hall not be stored either upon the sidewalks or roadways of streets, and shall be removed herefrom from day to day as rapidly as roduced. When dry rubbish is being andled, it shall be kept wetted down so as o prevent its being blown about by the wind.

825. **Use of Derricks.)** For all buildings more than four stories in height the use f derricks set upon the sidewalk or street s prohibited. In no case shall the guy lines e less than fifteen feet above the roadbed.

826. **Frontage Adjacent — How Occupied or Building Purposes.)** If the written consent of and a waiver of claims for damages gainst the city by the owners of properties djoining the site of any proposed building s first obtained and filed with the Commissioner of Public Works, the permission to ccupy the roadway and the sidewalk may e extended beyond the limits of such building in front of the property for which the onsent of the owner or lessee thereof has een secured upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of he building site.

827. **Street—Use of for Building Purposes—When Terminated—Red Lights.)** (a) The permission to occupy streets and sidewalks for the purposes of building is intended only for use in connection with the actual erection, repair, alteration or removal of buildings, and shall terminate with the completion of such operation. It hall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by he Department of Buildings. It shall also e unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for immediate use in connection with the operations for which such permit has been issued.

(b) Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

828. **Street Obstructions—Permits—Bonds —Fees.)** (a) Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid in proportion to the street frontage occupied at the rate of five dollars per month for every twenty-five feet or fractional part thereof, of frontage so occupied, and before any permit shall be granted to any person, firm or corporation for the obstruction of any street or streets or sidewalk, an estimate of the cost of restoring said street and sidewalk to a condition equally as good as before it shall have been obstructed, with a fair additional margin for contingent damages, shall be made by the Commissioner of Public Works. Such estimate in no case shall be less than two dollars per foot, or fractional part thereof, frontage of the portion of the street to be obstructed, and a deposit shall be required of the person, firm or corporation desiring to obstruct said street or sidewalk. Such deposit, less the charge of five dollars per month for each twenty-five feet of frontage used, shall be returned upon the restoration of the said street and sidewalk to a condition equally as good as before it was obstructed. When the Commissioner of Public Works shall receive satisfactory proof that said street and sidewalk have been restored to a condition equally as good as before it was obstructed, he shall issue a certificate to the Comptroller, certifying to said fact, and the comptroller shall thereupon forthwith issue a warrant on the City Treasurer for the amount of money thus deposited less the deduction herein provided for. But if the person, firm or corporation thus obstructing said street or sidewalk shall fail to restore the same to a condition equally as good as before it was obstructed within three days from and after the completion of the building or structure for which said deposit was required, then the city shall have the right to use such portion of said deposit as may be necessary to remove the obstructions and to restore the said street and sidewalk to a condition equally as good as it was before it was obstructed, and the amount thus expended shall be deducted from the amount of said deposit; provided, however, that nothing herein contained shall preclude the city from maintaining any action against the person, firm or corporation to recover for damage done to any street or sidewalk. No permit shall be issued until the applicant therefor shall have executed and filed with the Commissioner of Public Works a bond, with sureties to be approved by said Commissioner, and in an amount to be designated by him, in no case to be less than ten thousand dollars, conditioned to indemnify, save and keep harmless the city from any and all loss, cost, expense or liability of any kind whatsoever which it, the city, may suffer or be put to, or which may be recovered from it from or by reason of the issuance of such permit, or by reason of any act or thing done or neglected to be done under or by virtue of the authority given in such permit and the requirements of the city ordinances.

(b) Any permit issued pursuant to the terms of this section may be revoked by the Commissioner of Public Works at any time.

829. **Building Operations at Night in Residential Districts Prohibited—Penalty.)** It shall be unlawful for any person, firm or corporation, in conducting any building operations between the hours of ten o'clock in the evening and four o'clock in the morning to operate or use any pile drivers, steam shovels, pneumatic hammers, derricks, steam or electric hoists or other apparatus, the use of which is attended with loud or unusual noise in any block in which more than half of the buildings on either side of the street are used exclusively for residence purposes.

Any person, firm or corporation violating any of the provisions of this section shall be fined not less than five dollars, nor more than one hundred dollars for each offense, and each day's violations of same shall be considered a separate and distinct offense.

830. **Stables and Barns — Regulations.)** (a) It shall be unlawful for any person, firm or corporation to convert any building for the use of or to construct or maintain any stable or barn for the housing or keeping of more than two horses or other animals on any lot abutting on a street or alley in which a public sewer is constructed without providing such stable or barn with an impervious floor properly drained to such sewer.

(b) It shall be unlawful for any person, firm or corporation to construct, locate, conduct or maintain any boarding, sales or private stable or barn for stabling or keeping of horses on the front two-thirds of any lot on any street where one-half of the buildings on both sides of the street between the next nearest intersecting streets are used exclusively for residence purposes without the written consent of a majority of the property owners according to frontage on both sides of the streets. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for such purpose. Provided that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

(c) It shall hereafter be unlawful for any person, firm or corporation to locate, build, construct or maintain any building or structure for stabling or keeping of ten or more horses within a distance of four hundred feet from any school, church, hospital, public park or public playground.

(d) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00) for each offense and each and every day on which such person firm or corporation shall conduct or maintain a stable or barn in violation of the provisions of this section, shall constitute a separate and distinct offense.

831. **Tannery Not to Be Placed Within 600 Feet of Any Church, Public or Private School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any building used, or to be used, for a tannery within six hundred feet of any building used for a church, hospital, public or private school, measured from the nearest point of the tannery to the nearest point of such church, hospital or school.

832. **Gas Reservoir Not to Be Placed Within 500 Feet of any Public School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any tank used or to be used for a gas reservoir within 500 feet of any public school. Said distance to be measured from the nearest point of the building or structure used for a gas reservoir to the nearest point of any building used for a public school.

ARTICLE XIV.

Fireproof Construction.

833. **Fireproof Construction — Definition of.)** The term "fireproof construction" shall apply to all buildings in which all parts that carry weights or resist strains and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator inclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and hereinafter termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction, when built as required by Section 776.

834. **Fireproof Material — Definition of.)** The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta.

835. **Fireproof Construction—Tests For—Board of Examiners.)** (a) In cases in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this Chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have at least ten years' experience as an architect, engineer or builder, who shall take the usual oath of office. Said oath of office shall be administered by the Commissioner of Buildings. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction or material, or device for fireproofing, and furnish a copy of the same to the applicant. And such specifications shall provide that the material to be tested shall withstand successfully a fire of two hours' duration, rising to 1,700 degrees temperature, Fahrenheit, in the first thirty minutes and remaining at that temperature for the following ninety minutes. At the end of the two hours the material shall be quenched for at least five minutes with a stream of water from a one and one-eighth inch nozzle, at a nozzle pressure of fifty pounds per square inch. The said examiners shall notify such applicant to submit the proposed material for such examination and test; and such tests shall be made in the presence of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners and such examinations and tests, shall be paid by the applicant, and said examiners may require security therefore.

(b) The said examiners shall within 30 days after such examination and tests, certify the results of such test, and their decision on the said application to the Commissioner of Buildings, who shall in the event of the examination and tests being satisfactory, authorize the use of such material or construction as fireproof material.

(c) A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

(d) The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fireproofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this Chapter.

836. **Incombustible Material.)** The following materials shall be considered as incombustible material: A metal or fire-resisting glass not less than one-quarter of an inch in thickness, metal, plastering on metal lath and metal-studding, plaster blocks, stone, granite, marble, approved cinder concrete, or one of the fireproof materials described in this chapter.

837. **Walls — Enclosing in Buildings of Steel Skeleton Construction.)** If buildings are made of fireproof construction, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall not be less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

838. **Columns — Exterior.)** (a) All iron or steel used as vertical supporting member of the external construction of any building exceeding fifty feet in height shall be protected against the effects of external change of temperature, and of fire by a covering of fireproof material consisting of at least four inches of brick, hollow terra cotta concrete, burnt clay tiles, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The distance of the extreme projection of the metal, where such metal projects beyond the face of the column, shall be not less than two inches from the face of the fireproofing; provided, that the inner side of exterior columns shall be fireproofed as hereafter required for interior columns.

(b) Where stone or other incombustible material not of the type defined in this ordinance as fireproof material is used for the exterior facing of a building, the distance between the back of the facing and extreme projection of the metal of the column proper shall be at least two inches,

and the intervening space shall be filled with one of the fireproof materials.

(c) In all cases, the brick, burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

(Exterior and Interior Illustrations on the next page.)

839. **Columns — Interior.)** (a) Covering of interior columns shall consist of one or more of the fireproof materials herein described.

(b) If such covering is of brick it shall be not less than four inches thick; if of concrete, not less than three inches thick; if of burnt clay tile, such covering shall be in two consecutive layers, each not less than two inches thick, each having one air space of not less than one-half inch, and in no such burnt clay tile shall the burnt clay be less than five-eighths of an inch thick; or if of porous clay solid tiles, it shall consist of at least two consecutive layers, each not less than two inches thick; or if constituted of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, provided that if concrete is used for such layer it shall not be less than two inches thick.

(c) In the case of columns having an "H" shaped cross section or of columns having any other cross section with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to two and one-half inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direction perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the columns, shall be filled solid with fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

840. **Columns — Wiring Clay Tile On.)** (a) Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around tile in such manner that every tile is crossed at least once by a wire. If iron or steel wire is used it shall be galvanized and no wire used shall be less than number twelve gauge.

(b) In places where there is trucking or wheeling, or handling of packages of any kind, the lower five feet of every column incased with hollow tile shall be incased in a protective covering of No. 16 U. S. gauge steel embedded in concrete.

841. **Concrete—Approved Cement—When Fireproof.)** (a) All approved cement concrete shall consist of a standard Portland cement, torpedo sand, and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of all materials except the Portland cement shall not exceed eight times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

(b) Cement concrete to be considered a fireproof material shall comply with the provisions of Section 776 and shall be cast and worked in an unset condition against the metal. In all cases where cinder concrete is used, the metal shall be protected as required by Section 780 of this Chapter.

842. **Concrete Ingredients.)** (a) The separate ingredients of concrete shall be measured for each batch, and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing. The concrete shall be worked continuously with suitable tools, as it is put in place, filling the forms completely.

(b) The sand to be used for concrete shall be clean coarse sand, free from loam or dirt. If crushed stone grit is used it shall be clean, gritty, and free from dust.

(c) The stone to be used in concrete shall be clean crushed hard stone, or clean crushed blast furnace slag, or gravel, and of a size to pass through a 1½-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using.

(d) In all cases, the brick or hollow tile, solid tile, or terra cotta shall be bedded in cement mortar close up to the iron or steel member and all joints shall be made full and solid.

843. **Pipes Enclosed by Covering.)** (a) Pipes shall not be enclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building; provided, however, gas or electric light conduits not exceeding one inch diameter may be inserted in the outer three-fourths inch of the fireproofing of such structural member, where such fireproofing is entirely composed of concrete.

(b) Pipes or conduits may rest upon the tops of the steel floor beams or girders, provided they are imbedded in cinder concrete to which slaked lime equal to five per cent of the volume of concrete has been added before mixing or their being imbedded in stone concrete.

844. **Shafts—Doors—Frames—Enclosure.)** (a) In cases where a pipe, conduit, dumb waiter, cable wire, conveyor, belt, or any combination thereof, passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening in each story above and below such hatch or floor opening in the same manner as described for fireproof partitions in this chapter, and no wood shall be used in the construction, support or fittings of such shaft. The area of space thus enclosed shall not exceed the area of the floor opening by more than one hundred per cent.

(b) All burnt clay or terra cotta partitions or walls around such shafts shall be plastered on the outside and plastered or pointed on the inside.

(c) All doors, frames, sashes, casings and windows in partitions or walls around such floor openings, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material. In the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness, the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be wired glass.

(d) Such fireproof enclosure may be omitted if all of the space in such floor opening not occupied by pipes, conduits, cables, wires, or any combination thereof, are filled in solid fireproof material not less than eight inches thick.

845. **Spandrel Beams, Girders, Lintel.)** The metal of the exterior side of the spandrel beams or spandrel girders of exterior walls, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material as specified for the exterior columns in this chapter; provided, however, that shelf angles connected to girders by brackets or projections of girder flanges not figured as part of the flange section, may come within two inches of the face of the brick or other covering of such spandrel beams, girders or lintels. The covering thickness shall be measured from the extreme projection of the metal in every case.

(Illustrations of beams on next page.)

846. **Beams, Girders and Trusses—Coverings of.)** (a) The metal beams, girders and trusses of the interior structural parts of a building shall be covered by one of the fireproof materials hereinbefore specified so applied as to be supported entirely by the beam or girder protected, and shall be held in place by the support of the flanges of

Fig. 40.

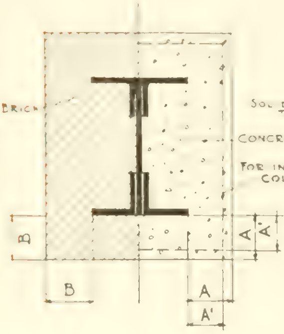


Fig. 41.

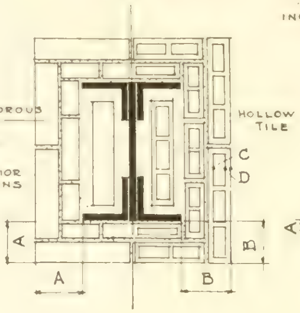
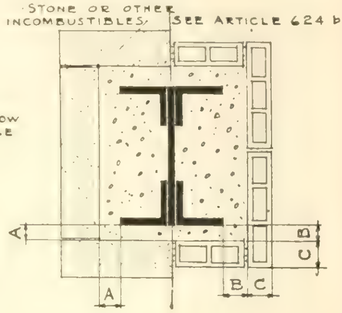


Fig. 42.



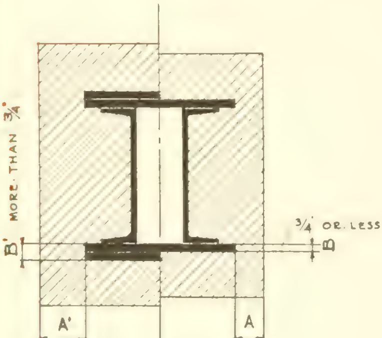


Fig. 43.

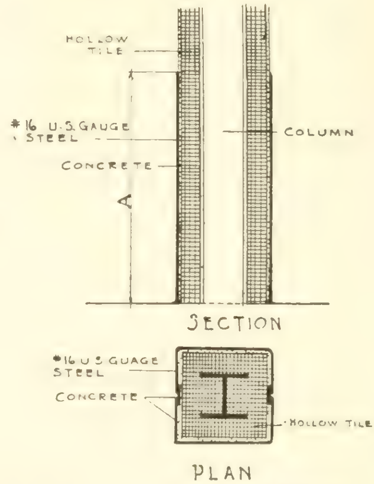


Fig. 44.

PROTECTION OF EXTERIOR COLUMNS.

Section 838.

Figs. 40, 41, 42. Requirement for protection of columns of building exceeding 50 ft. height from external change of temperature and fire.

Fig. 40. (A) 4″ concrete required.
(B) 4″ brick required.

Fig. 41. (A) 4″ solid porous tile required.
(B) 4″ hollow tile required.

Fig. 42. (A) If stone or other incombustible material is used for exterior facing then (A) can equal 2″.

(B) (C) Combination of materials in fire-proofing, etc., is allowed as at (B plus C), providing their combined thickness is not less than 4 inches.

PROTECTION OF INTERIOR COLUMNS.

Section 839.—Requirements for Interior Columns.

Fig. 40. (A′) Concrete 3″ (shown dotted).
(B) Brick 4″.

Fig. 41. (A) Solid porous tile, two layers of 2″ each tile.

(B) Hollow tile, 2 layers of 2″ each.

For hollow tile (C) is to equal 1½″ air space, and (D) not less than ⅝″.

Fig. 42. (B plus C). Each equal ½ thickness required, if used singly, provided if concrete (B) is used it shall not be less than 2″.

Section 839c.

Fig. 43. In case of H shaped cross section of columns, etc., fire-proof covering may be reduced to 2½″ (A) providing (B) flange projection is ¾″ or less.

If (B) is more than ¾″ as at (B′) then A must be as before specified for interior columns as at (A′).

Section 840b.

Fig. 44. Drawing showing protective casing for lower part columns. (A) = 5′ 6″.

such beams or girders and by the cement mortar used in setting.

(b) If the covering is of brick, it shall be not less than four inches thick; if of hollow tiles or if of solid porous tiles, or if of terra cotta, such tiles shall be not less than two inches thick, applied to the metal in a bed of cement mortar; hollow tiles shall be constructed in such a manner that there shall be one air space of at least three-fourths of an inch by the width of the metal surface to be covered within such clay coverings the minimum thickness of concrete on the bottom and sides of metal shall be two inches.

(c) The top of all beams, girders, and trusses, shall be protected with not less than two inches of concrete or one inch of burnt clay bedded solid on the metal in cement mortar.

(d) In all cases of beams, girders or trusses, in roofs or floors, the protection of the bottom flanges of the beams and girders entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials, excepting the air spaces in hollow tile.

(e) Provided, however, that all girders or trusses when supporting loads from more than one story shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials as required for interior columns in Section 839 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

(f) The fireproofing herein required for metal structural roof members may be omitted in buildings used exclusively for purposes of Class IV and of Class V, when such structural roof members support only roof loads and ceiling construction over interior open spaces under the following conditions. A continuous ceiling of incombustible material shall be suspended below the roof from the structural roof members. There shall be no openings in ceilings other than those required for ventilation. Where the plane of the ceiling is twenty feet or more above the floor of the open space, all structural members or parts thereof projecting below said ceiling shall be fireproofed as required by the provisions of this Chapter. The fireproofing to extend upward two inches above the ceiling level. Where the plane of the ceiling is nearer than twenty feet to the floor of the open space all structural members above or below such ceiling to the height of twenty feet above the highest point of the floor of the open space shall be fireproofed as required by the provisions of this Chapter. Openings in ceilings for ventilation shall be connected by a conduit or duct to the outside of the building. Ducts shall be of metal or other incombustible material and if of metal where such ducts have an area greater than 100 square inches same shall be constructed double with an intervening air space.

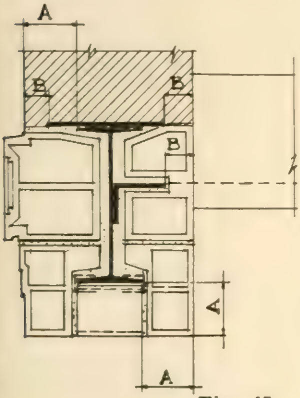


Fig. 45.

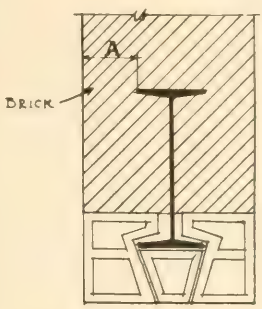


Fig. 46.

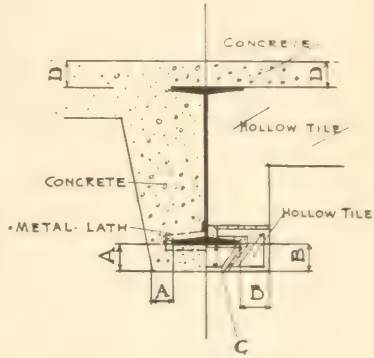


Fig. 47.

PROTECTION OF BEAMS.
Section 845, 846.

(A) Fire-proof covering for beams, girders, etc., for exterior structural parts, Sec. 845. See provisions for columns (Sec. 838) for A.

Fig. 45. (B) Allowable covering for shelf angles, etc., not figured part of flange section to be 2″.

Figs. 45, 46, 47. Necessary fire-proof covering for beams, girders, etc., for interior structural parts (Sec. 618).

Fig 46. (A) 4″ for brick (Sec. 846b).

Fig. 47. (B) 2″ for hollow tile or solid tile (Sec. 618b).

(A) 2″ for concrete (Sec. 846b).

(C) ¾″ air space by width of metal surface to be covered as required (Sec. 846b).

(D) Concrete covering for tops of beams, girders, etc., to be 2″ (Sec. 846c).

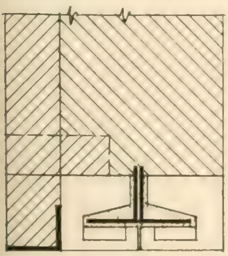


Fig. 48.

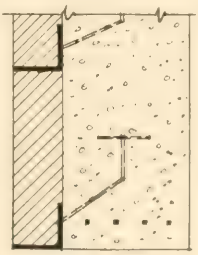


Fig. 49.

Where lintels are fireproofed previously and independently, the Commissioner of Buildings has ruled that the application of the architectural facing may be supported as shown (Fig. 48, 49).

and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the

847. **Fireproofing of Exterior Sides of Mullions.)** In buildings required by this chapter to be of fireproof construction or exposures where metal frames, doors, sash and wired glass are not required, all vertical door or window mullions over eight

inches wide shall be faced with incombustible material, and horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

848. **Fireproof Covering, Independent.)** The fireproof covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previous to and independent of the application of the architectural facing of such fireproof building with an incombustible or fireproof material.

849. **Walls, Support and Fireproofing of.)** Where skeleton construction is used for the whole or part of a building the enveloping material and the walls shall be independently supported on the skeleton frame for each individual story.

850. **Iron or Steel Plates for Support of Wall.)** Where iron or steel plates or angles are used in each story for the support of the facings of the walls of such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fibre stress for iron and steel elsewhere specified in this chapter of the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

851. **Cut-out Boxes, Chases, Etc.—Fireproof Covering.)** No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or if any other recess is to be concealed, or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

852. **Segmental and Flat Arches.)** (a) Segmental arches shall have a rise of at least one inch for each foot of span of arch.

(b) The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but no such hollow tile or terra cotta arch shall be of a thickness less than five inches.

(c) Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skewback of the arches shall be carefully fitted to the beams supporting them, and, in addition to the cross ribs, there shall be additional diagonal re-enforcing ribs in the skewback. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the centers shall not be struck until the mortar has set.

(d) Burnt clay skewbacks shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

853. **Fireproof Floor and Roof Construction.)** Brick, hollow tile, porous terra cotta, or approved cement concrete, or approved cinder concrete, shall be used for the construction of floor and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inches for each foot of span.

854. **Wood Flooring and Nailing Strips.)** (a) Wood flooring and wooden nailing strips for such flooring may be used in fireproof buildings.

(b) Where such flooring is used in a fireproof building, the space immediately under the flooring, and between the nailing strips and under such nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or with such other incombustible material as shall be approved by the Commissioner of Buildings.

855. **Partitions in Fireproof Buildings.)** (a) Where stairs, shafts and elevators are enclosed they shall be enclosed in fireproof partitions, as described in Section 856 of this chapter; all other partitions, shall be incombustible partitions. Where blocks are used for building partitions, the joints shall be well filled with mortar.

(b) The partitions shall be wedged tight between floor and ceilings with incombustible wedges.

856. **Partitions — Fireproof — Incombustible.)** (a) Only fireproof material shall be used for fire proof partitions; if of brick, they shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than three inches thick.

(b) All fireproof partitions required by this ordinance shall be supported directly on the steel construction, or on the fireproof floor arches, or on concrete, or on brick.

(c) Only fireproof or incombustible material shall be used in the construction of partitions not required to be fireproof, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

(d) All corridor partitions of incombustible or fireproof material in fireproof buildings, shall be supported directly on the steel construction, on the fireproof floor arches, on concrete or on brick.

857. **Stairs—Landings.)** (a) Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or metal, or a combination of one or more of such materials.

(b) The handrails of such stairways may be of wood.

(c) If stairs are constructed of solid stone or plain concrete, having the tread and riser in one piece, then there shall be not less than sixty square inches of stone or concrete in the cross section of such combined tread and riser.

(d) If stone treads have less than sixty inches of cross section and platforms less than seven inches in thickness are used, they shall have a metal sub-tread and sub-platform three thirty-seconds of an inch thick.

(e) If platforms have a floor arch sub-construction as described in Section 852 and 853 of this chapter, then the metal sub-platform may be omitted.

858. **Roofs—Rise of Roof Above Limit of Height.)** In the case of buildings which are fireproof in their construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of the wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an inclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

859. **Sheet Metal Work—Support Of.)** Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than fifty feet in height.

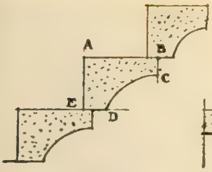


Fig. 50.

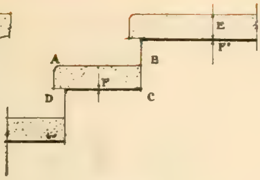


Fig. 51.

Section 854c.

Fig. 50. Area of cross section A B C D E shall not be less than 60 sq. inches.

Section 854d.

Fig. 51. If area of cross section (A B C D) is less than 60 sq. inches or (E) (thickness of platform) less than 7 in., then metal sub-tread F and sub-platform F′ (=: 3/32 in. thickness) is required.

Section 854e gives exception to above.

ARTICLE XV.

Slow Burning Construction.

860. **Slow-Burning Construction Defined.)** The term "Slow-Burning Construction" shall apply to all buildings in which the structural members, other than walls elsewhere required to be of masonry, which carry the loads and strains which come upon the floor and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted where such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. The lower five feet of metal columns shall be protected as required in Section 848 of this Chapter. Underside of joists shall be protected by a covering of three coats of plaster laid on metal lath; and a layer of mortar or other incombustible material at least one and one-half inches thick shall be applied on all floors and roof surfaces above the joists of same.

The fireproofing herein required for metal structural roof members may be omitted in any building of slow-burning construction used exclusively for purposes of Class IV of seating capacity less than one thousand persons or in any building of slow-burning construction used for purposes of Class IV in combination with any other Class where such part of such building as is used for purposes of Class IV has a seating capacity of less than one thousand persons and is separated from all other parts of such building by brick walls of thickness required in this Chapter and also by floors of fireproof construction, when such structural roof members support only roof loads and ceiling construction over interior open spaces under the following conditions. A continuous ceiling of incombustible material shall be suspended below the roof from the structural roof members. There shall be no openings in ceiling other than those required for ventilation. Where the plane of the ceiling is thirty feet or more above the floor of the open space all structural members or parts thereof projecting below said ceiling shall be fireproofed as required by the provisions of this Chapter, the fireproofing to extend upward two inches above the ceiling level. Where the plane of the ceiling is nearer than thirty feet to the floor of the open space all structural members above or below such ceiling to the height of thirty feet above the highest point of the floor of the open space shall be fireproofed as required by the provisions of this Chapter. Openings in ceiling for ventilation shall be connected by a conduit or duct to the outside of the buildings. Ducts shall be of metal or other incombustible material, and if of metal where such ducts have an area greater than 400 square inches same shall be constructed double with an intervening air space. The floor levels of balconies and galleries having a gross area of less than fifteen per cent (15%) of the gross area of the floor of such open space shall not be used as a basis for calculating the height of such fireproofing.

861. **Posts, Girders and Partitions.)** Wood posts, if used, shall be of not less than one hundred square inches sectional area. Wood girders, if used, shall be of not less than seventy-two square inches sectional area. All partitions in buildings of this type shall be made entirely of incombustible material. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

862. **Stair, Construction of.)** Where buildings are required to be of "slow burning" construction, all stairs in such building shall be of incombustible material, except as hereinafter provided. Said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system, and stairs are enclosed in a fireproof wall.

ARTICLE XVI.

Mill Construction.

863. **Definition — Mill Construction Requirements.)** The term "Mill Construction" shall apply to all buildings in which wooden posts, if used, have a sectional area of not less than one hundred square inches, and wooden girders and joists a sectional area of not less than seventy-two square inches, and roofs, if of wood, a thickness of not less than two and five-eighths inches in a single layer, except where the building is equipped throughout with a sprinkler system, subject to the approval of the Chief of Fire Prevention and Public Safety, in which event such layer may be not less than one and five-eighths inches thick, and floors, if of wood, a thickness of not less than three and one-half inches in not more than two layers, the lower one of which shall be not less than two and five-eighths inches in thickness, and in which all structural metallic members, if used, are fireproofed as required for fireproof construction. Where metallic lintels are used to cover wall openings the fireproofing on the underside may be omitted in case such lintels are fireproofed on the other three sides and all voids in them are filled solid with fireproof material. All floors and roofs not constructed as above shall be of fireproof construction as elsewhere required for fireproof construction in this chapter.

864. **Fireproofing.)** (a) Partitions in buildings of mill construction shall be made entirely of incombustible material. If iron columns, girders, or beams are used in buildings of this type they shall be protected as specified in this Chapter; but the wooden posts, girders and joists need not be protected by fireproof covering. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.

(b) If reinforced cinder concrete construction is used in the structural parts of a building which is required to be of slow-burning or mill construction by this chapter, then all partitions shall be of incombustible material and all parts other than structural parts and partitions of the building shall be as required for slow-burning or mill construction buildings by this chapter.

865. **Stair Construction Where Automatic Sprinkler System is Installed.)** In buildings required to be of "mill construction," all stairs in such buildings shall be of "incombustible" material, except as hereinafter provided. Said stairs may be of wood construction if said building is equipped with an automatic sprinkler system and stairs are enclosed in a fireproof wall.

ARTICLE XVII.

Ordinary Construction.

866. **Ordinary Construction Defined.)** The term "ordinary construction" as used in this chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire-resisting coverings and in which the walls are of masonry built as required by this chapter.

ARTICLE XVIII.

Frame Buildings.

867. **Repairing of Frame Buildings Within Fire Limits.)** Frame buildings within the fire limits which have been damaged by fire, decay or otherwise, to an extent not greater than fifty per cent of their value may be repaired, provided there is no increase in size of such buildings over their original dimensions, and, provided that incombustible roof covering required by Section 811 is used. And, provided, further, that where any frame building is raised for the purpose of erecting a basement story under the same, the walls enclosing such basement shall be of masonry.

868. **Frame Buildings Prohibited—Exceptions.)** (a) Hereafter no frame building shall be erected, nor any frame addition made to an existing frame building within the fire limts of the city, except where express provision is made in this chapter therefor.

(b) Outside the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet. Provided, however, that in no case shall any portion of any frame building above the second floor be used as a separate living apartment.

(c) It shall be lawful to surround frame buildings with a veneer of brick not less than four inches in thickness, provided the said brick is not carried higher than the second story, or twenty-two feet above the basement ceiling; and provided further that the said veneer is anchored to the studding or other frame construction in a manner satisfactory to the Commissioner of Buildings. Such brick veneer is not to be placed on gables or any other parts of frame buildings above the height herein specified. All frame buildings which it is desired to surround with brick veneer must have their basement walls and foundations of solid masonry, as provided in Section 872.

869. **Frame Buildings Within the Fire Limits Changed Into Flat Buildings—Fire Walls.)** Whenever any frame building within the fire limits shall be remodeled, altered or changed for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

870. **Frame Buildings—Raising—Requirements—Changing Gable or Hip Roofs to Flat Roofs.)** Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more, and inside the fire limits for the purpose of putting a masonry basement thereunder. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roof, and in no case shall a two-story and attic building be converted into a three-story building thereby.

871. **Frame Buildings Carried to a Uniform Height.)** Where the different parts of a frame building inside the fire limits are of different heights a one-story portion may be raised to the height of two stories, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings and provided, that no room in the existing building or in the addition thereto shall violate the requirements of this chapter for habitable rooms.

872. **Basement or Story Placed Beneath Frame Buildings.)** A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than 16 feet above the grade of the sidewalk upon which such premises abut. Where a building so raised is one story in height only and the same is raised so as to permit a basement under the same not to exceed six feet six inches in height from the basement floor to the ceiling of said basement, the said house may be placed upon cedar posts. In all other cases the walls enclosing such basement or story shall be of masonry and not less than 12 inches thick except where a one-story frame building is raised and has a basement only built thereunder, the masonry walls of such basement may be eight inches thick above grade and 12 inches thick below. The foundation of such wall shall be constructed as provided in this chapter; provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thickness of walls hereinbefore required shall also apply to brick walls in new frame buildings.

873. **Chimneys in Frame Buildings—Chimney Flues Through Partitions.)** Chimneys in frame buildings shall be built as required by Section 800 of this chapter. The wood framing of frame buildings shall be trimmed around chimneys in such a manner as not to come within two inches of same.

874. **Lot Lines—Requirements as to—Number—Dimensions.)** Frame buildings, excepting sheds not exceeding three hundred square feet in area and not exceeding fourteen ft. in height from the ground, shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted, except as hereinafter provided. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness of not less than four inches and of construction to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, unenclosed by such fire walls, and if openings are inserted in such fire walls, then such walls shall be built of brick not less than eight inches thick, and such openings shall have doors as described in Section 789. Each section of such buildings shall be regarded as a separate building for the purpose of determining the number and construction of its stairways and means of egress. If more than one frame building is built in the direction of the depth of any one lot, such

buildings shall not be built with a less distance than ten feet between them except where both buildings are used for living purposes, and in that case the distance shall be governed by Sections 641 and 642 of this chapter.

875. **Sheds—Open Shelter—Height of Walls and Foundations—Enclosed.)** (a) Except as hereinafter provided, open shelter sheds not exceeding eight hundred square feet in area may be erected within the fire limits, provided they have roofing of incombustible material and the highest point is not over fifteen feet above the ground, and provided that the roofs be supported on sufficient posts or piers; provided further, however, that such sheds may be built with an area not to exceed sixteen hundred square feet, if they are kept at least twenty-five feet from any lot line and any other building or structure. Such sheds shall have no combustible enclosing walls or wooden floors, except that a floor of two-inch planking laid directly upon the ground may be used. Such sheds shall only be erected upon the rear of the lot, and not more than one such shelter shed or any other shed shall be erected on any lot of twenty-five feet in width.

(b) If it is desired to enclose an open shelter shed, the enclosing walls shall be made of brick, hollow tile, or other incombustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

(c) Open shelter sheds may be erected outside the fire limits not to exceed twenty-eight hundred square feet in area and subject to the approval of the Commissioner of Buildings; provided, however, that shelter sheds which comply in other respects with the requirements of this section, may be built not to exceed nine thousand square feet in area where such sheds are located at least twenty feet distant from any other structure and from any lot line.

(d) It shall be lawful to erect inclosed wooden shelter sheds at any fire department station in the city for the storage of fuel and supply wagons. Such sheds shall not exceed twenty-five feet in width, thirty feet in length and fourteen feet in height.

(e) Sheds not exceeding fourteen feet in height from the ground to the highest point thereof, and not exceeding three hundred square feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.

876. **Sheds—Coal, Brick, Stone, Cement and Salt Sheds and Sheds for Icing Cars Along Railroad Tracks and Navigable Streams.)** Open shelter sheds to be used for the storage or handling of coal, brick, stone, cement, salt or such commodities which are incombustible, or for the icing of cars, may be erected within or without the fire limits upon, along or adjacent to steam railroad tracks, or along or adjacent to navigable waters; provided, such sheds shall have incombustible roofing and shall not exceed 35 feet in height from the ground to the highest point of the roof; provided, further, that said sheds shall be located at least 25 feet distant from any other structure and from any side lot line. If it is desired or intended to enclose any such sheds, the enclosing walls shall be of incombustible material. No such shed shall be built upon any lot or parcel of ground fronting upon any street within 200 feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall first have been obtained by the person, firm or corporation desiring to erect and maintain such shed, and said written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for such shed.

877. **Ice Houses.)** (a) Houses within the fire limits to be used exclusively for the storage of ice, not exceeding forty-five feet in height, and of a floor area not exceeding 9,000 square feet, may be constructed of wood with incombustible roofing, the walls to be enclosed with an envelope of incombustible material; eight-inch walls of brick or tile or approved cement concrete with proper foundations of masonry shall be used for such envelopes.

(b) Houses to be used exclusively for the storage of ice, located outside of the fire limits and contiguous to any lake and six hundred feet from any other building, except buildings used in connection with the conduct of said business, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed eighty thousand square feet, unless the building is divided by a solid wall of masonry for each additional 80,000 square feet of floor area, or fractional part thereof; and shall extend at each end not less than one foot beyond the enclosure of said building and such wall shall be subject to the approval of the Commissioner of Buildings.

(c) Houses to be used exclusively for the storage of ice, located outside of the fire limits, and contiguous to railroad tracks and not within one hundred feet of any other building, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed 20,000 square feet unless the building is divided by a solid wall of masonry for each additional 20,000 square feet of floor area or fractional part thereof; said wall shall extend at least one foot beyond the enclosure of said building on each end and shall be approved by the Department of Buildings.

(d) All dividing walls must extend through and above the roof of any building in which they are built to a distance of three feet and must be covered with incombustible coping. No dividing wall shall be of less thickness than twelve inches at any point thereof.

ARTICLE XIX.

Stairways.

878. **Stairways, Number—Location—Construction.)** (a) Fireproof office buildings existing at the time of the passage of this ordinance which are equipped either with one stairway and two or more stairway fire escapes or with two stairways and one or more stairway fire escapes, shall not be required to have additional stairways or stairway fire escapes.

(b) Except as otherwise expressly provided in this Article, it shall be unlawful to construct or maintain any building or structure of Classes I, II and VII unless its stairway or stairways comply with the following provisions:

(c) In every existing building of ordinary construction having an area greater than 9,000 square feet or of mill or slow-burning construction greater than 12,000 square feet, there shall be not less than three stairways. The width of stairs shall be at least eighty per cent of the width of stairs as computed by the formula given herein and in no case less than twelve feet.

(d) Every building shall have at least one stairway from the ground to the top floor and one stairway from the lowest basement or cellar to the street grade, and no stairway shall be less than three feet in width.

(e) The width of stairs required for a building shall be construed as the total width of all stairways required on the building. Stairs shall be measured between the wall and handrail for a single stair and between handrails where two or more handrails are required by this chapter.

(f) In buildings of Class I and Class IIa the width of stairs and fire escapes required for a building shall be determined by the floor area measured on the third floor of the building and such area shall not include walls, columns, stairs, elevator shafts, well holes, chimneys and corridors. In all cases where the building is less than three stories in height the width of stairs shall be determined by the floor area of the second floor as hereinafter specified.

(g) Where the enclosed space between a ceiling and the roof of a building of any Class is of greater average height than two feet in the clear, access shall be provided by means of at least one stairway not less than three feet wide leading from a public hallway or corridor.

(See Illustration, Sec. 613).

879. **Stairs—Number and Width of in Classes I, II and VII.)** (a) In buildings of Class IIb, Class IIc and Class VII the number and width of the stairs and fire escapes shall be determined by the area of that portion of the third floor not occupied by walls, columns, stairs, elevator shafts and wellholes.

In buildings of Class I, II and VII the number and width of stairs required shall be as follows:

(b) In Ordinary Construction.

With floor area of 5,000 square feet or less, two stairways;

With floor area of 5,000 to 9,000 square feet, three stairways.

Provided, however, that in buildings of ordinary construction, existing prior to December 5, 1910, with floor area of 5,000 square feet or less, one stairway only shall be required where the building is also equipped with an outside stairway fire escape, and in all such buildings with floor area of from 5,000 to 9,000 square feet, two stairways only shall be required; in case such building is also equipped with an outside stairway fire escape. Where such buildings are equipped with ladder fire escapes, erected in compliance with the ordinance now in force, one-half the width of such ladder fire escape shall be credited in computing the width of stairs required therein.

(c) The width of stairs required in buildings of ordinary construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by twelve and dividing the product by 1,000 and adding 72 inches to the quotient, expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3000) \text{ times } 12}{1{,}000}$$

(d) In Mill or Slow-Burning Construction.

With floor area of 6,000 square feet or less, two stairways.

With floor area of 6,000 to 12,000 square feet, three stairways.

(e) The width of stairs required in buildings of mill or slow-burning construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by eight and dividing the product by 1,000 and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3{,}000) \text{ times } 8}{1{,}000}$$

(f) In Fireproof Construction.

With floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

With floor area of 21,000 square feet and over, five stairways.

(g) Provided, however, that in fireproof buildings having an area of 21,000 square feet or more only four stairways shall be required if such building is completely equipped with an approved automatic sprinkler system.

(h) The width of stairs required in buildings of fireproof construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by six and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3{,}000) \text{ times } 6}{1{,}000}$$

(i) Provided, however, that where buildings of Class I are of fireproof construction and are used solely for storage warehouse purposes and the number of persons employed on any one floor does not exceed the number specified hereafter in this section they shall comply as to number of stairways as follows:

With floor area less than 8,000 square feet where not more than ten persons are employed on a floor, two stairways.

With floor area greater than 8,000 square feet and less than 15,000 square feet where not more than fifteen persons are employed on a floor, three stairways.

With floor area greater than 15,000 square feet where not more than twenty persons are employed on a floor, four stairways.

(j) The width of stairs shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by four and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}-3{,}000) \text{ times } 4}{1000}$$

(k) Provided, however, where buildings of Class I are used solely for storage or warehouse purposes and the number of persons regularly employed above the floor nearest the street level does not exceed ten persons or where the number of persons occasionally employed above the floor nearest the street level does not exceed twenty persons, the floor area of such building may be increased fifty per cent (50%) in excess of the area limits as provided in this Section for buildings of Class I of ordinary, slow-burning mill or fireproof construction for the given number of stairways. The width of such stairways shall be as determined by use of formula given for each separate type of construction, by using two-thirds of the actual floor area of such building as a basis for the calculation, and by substituting the words and figures, "54 inches," for the words and figures, "72 inches," where they occur in said formula. There shall be not less than two stairways, or one stairway and a stairway fire escape directly accessi-

ble from each area of such building, and the location of all stairways and fire escapes shall be subject to the approval of the Commissioner of Buildings. The minimum width of any stairway in such buildings now in existence shall be not less than thirty inches (30"), the minimum width of any stairway in such buildings hereafter erected or hereafter converted to such use shall be not less than thirty-six inches (36"), and the minimum width of any fire escapes shall be not less than twenty-four inches (24").

880. **Stairs—Other Requirements.)** (a) The width of stairway fire escapes and three-quarters of the width of sliding fire escapes required by this chapter may be deducted from the width of stairs required.

(b) Stairways shall be located as far from each other as practicable. The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story and the line of travel from stairway to stairway shall be direct and easily accessible each to the other. At least one stairway shall extend to the roof of every building. In Classes I, II and VII, the whole number of stairways required for each building shall be complete in every respect from the first to the topmost story.

(c) Every story below the street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where a basement or cellar is used for the retail sale of goods the stairway from such basement or cellar shall in number and aggregate width comply with the requirement of this section for the first four stories above sidewalk grade.

(d) Where two areas of the same building adjoin and are separated by fireproof dividing walls they may have a stairway in common, provided such stairway is not less than five feet wide and is inclosed in all stories of the building by fireproof walls in non-fireproof buildings and by fireproof partitions in fireproof buildings; and where the stairways and landings are built as required by this chapter for buildings of fireproof construction, and where the doors, frames, sashes and casings, and the glazed portion thereof are built as described in Section 784 and 789 then in such case such stairway may be considered as equivalent to one open stairway from each such area, and where such stairway provides exit from only one floor area such stairway may be considered as equivalent to two open stairways but in no case shall there be less than two stairways in any such building except as otherwise provided in this chapter.

(e) Where adjoining buildings or buildings on opposite sides of an alley or other open space, and of the same class, used by the same person, firm or corporation, are connected by fireproof bridges or passageways with fireproof doors at each end, or by fireproof doors on each floor built and equipped as required by this chapter for dividing wall doors if such bridge or passageway or fireproof door is located as far as practicable from the stairways in both said buildings, then said bridge or passageway or fireproof door may be considered to be equivalent to a stairway for each of the two areas.

(f) In buildings of Classes I, II and VII, where an interior stairway is enclosed in a tower and built as required by the provisions of Section 881 paragraph (n) of this Chapter, then such stairway shall be considered the equivalent of two stairways, or a stairway and a fire escape; provided, however, that if such stairway is considered the equivalent of two stairways the building must be equipped with a stairway fire escape, or fire escapes, as is required by this Chapter.

(g) Exterior stairways in buildings of Class I, II and VII built entirely of steel and iron, having ice-proof treads not less than ten inches wide from nosing to riser and a rise of eight inches or less for each riser, and otherwise made as required for stairway fire escapes in this chapter and where such stairway fire escape extends from the inside grade to the top floor of the building or is supplied from the second floor to the ground with a counterbalanced section and has a steel ladder from the top landing to the roof, then such stairway may be considered the equivalent of one interior stairway and one stairway fire escape if the width of such stairway and that of the one or more stairways in the building equals the width of stairs required by this chapter; provided, that in such case the respective floors, door sills, and stairway platforms are flush, and that the doors do not obstruct the stairs or platforms and that the doors are each at least 90 per cent of the width of said stairway and that the windows, doors and frames passed by such stairway and platforms are built of incombustible material and wired glass.

(h) In buildings of Class I not more than three stories in height, a stairway fire escape not less than three feet wide located and built as required by this chapter for such fire escape and placed as far as practicable from the stairway, may be considered as a stairway and may be deducted from the "width of stairs" required for the building.

(i) The width of different stairways need not be alike, and for each four stories or fractional number of stories of the building above the first four stories each stairway may be reduced six inches, but no stair in a Class VII building shall be less than three feet in width.

(j) Stairways which are less than three feet three inches wide shall have not less than one hand rail and stairways which are more than three feet three inches wide shall have not less than two handrails. Stairways which are over eight feet wide shall have double intermediate handrails with end newel posts at least five and one-half feet high at all stair landings.

(k) Stairways hereafter erected shall not be spiral stairways or have any winders. Provided, however, that circular or elliptical stairways may be used if the width of treads one foot from the center of the handrail next to the well-hole is nine and one-half inches, including nosings.

(l) Stairways shall not have risers more than eight inches high nor treads less than ten inches wide, inclusive of nosings.

(m) The bottom of any counter-balance stairway or ladder fire escape hereafter erected on any public thoroughfare when raised shall be not less than fourteen feet above the pavement or surface of the street or alley.

(n) The location of every stairway required by this article shall be subject to the approval of the Commissioner of Buildings.

(See Illustration, Sec. 613)

ARTICLE XX

Fire Escapes.

881. **Fire Escapes — Number and Location.)** (a) It shall be unlawful for any person, firm or corporation to construct or maintain any building of Classes I, II, III, VI, and VII within the city, unless the same shall be equipped with fire escapes as follows:

(b) Every building four or more stories in height, except such as is used exclusively for a residence for one family shall have one

or more incombustible sliding or stairway fire escapes, as required by this chapter, except as otherwise herein provided.

(c) There shall be at least one stairway fire escape constructed as required by the provisions of this chapter for each 250 persons, or fractional part thereof, who occupy any floor of any building habitually and daily or for whom working, sleeping or living accommodations are provided on any one floor above the third floor of any building or structure.

(d) Buildings of Ordinary Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 6,500 square feet or less, one 24-inch stairway fire escape.

With floor area of 6,500 square feet to 9,000 square feet, two 24-inch stairway fire escapes.

(e) Buildings of Mill or Slow-Burning Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 8,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 8,000 square feet to 12,000 square feet, two 24-inch stairway fire escapes.

(f) Buildings of Fireproof Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 10,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 10,000 to 20,000 square feet, two 24-inch stairway fire escapes.

With floor area of more than 20,000 square feet, three 24-inch stairway fire escapes.

(g) Fireproof Warehouse Buildings Shall be Equipped with Fire Escapes as Follows:

With floor area of 12,000 square feet or less, one 24-inch stairway fire escape.

With floor area exceeding 12,000 square feet, two 24-inch stairway fire escapes.

(h) A fireproof bridge built as described in Section 880 and connecting each floor of two neighboring buildings occupied by the same person, firm or corporation, shall be considered the equivalent of a fire escape, or of an interior stairway, but not the equivalent of both.

(i) In buildings of Class II there shall be a stairway or a fire escape as near as practicable to the end of each corridor, and where a corridor is endless the stairs and the fire escapes shall be located around and connected to said hall or corridor at distances approximately equal to each other.

(j) The openings leading to fire escapes on hospitals shall be flush with the floor leading to the fire escape which may be inclined not more than 2½ inches vertical to 12 inches of horizontal measurement, and shall be constructed and maintained with no obstructions thereon.

(k) In buildings hereafter erected wherever stairway fire escapes are considered the equivalent of an interior stairway or as taking the place of any of the "Width of Stairs" required by this chapter, there shall be a door or casement window leading to such fire escape from each floor. Windows and doors to such fire escapes shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such windows or doors shall not be more than 24 inches above the floor, unless a stair is built leading to the same.

(l) Where a building is divided into separate areas, each such area shall be considered as a separate building and shall be equipped with stairs and fire escapes as is required for buildings by this chapter, unless otherwise herein provided.

(m) Exterior stairway fire escapes built as required by this chapter and having treads not less than 10 inches wide from nosing to riser and risers not more than 8 inches in height and having stairways extending from the inside grade to the top floor of the building or having a counterbalance section from the first story to the ground and a steel ladder from the top landing to the roof, shall be considered the equivalent of one interior stairway and one stairway fire escape, if the width of such stairway fire escapes with that of one or more stairways in the building equals the "Width of Stairs" required for the area of the respective buildings by this chapter.

(n) Where a Fire Shield Stairway is constructed according to the following provisions and requirements, such Fire Shield Stairway shall be considered the equivalent of a stairway or stairways or a fire escape and stairway or stairways combined, as per the provisions of Paragraph "f" of this section.

The Fire Shield Stairway shall be divided or separated from the building by, and completely enclosed with, brick walls or walls of fireproof material not less than twelve inches thick, or by a wall of reinforced concrete and tile in combination not less than ten inches thick subject to the approval of the Commissioner of Buildings. The walls are to be built from the lowest floor level to and at least thirty-six inches above the roof, except as otherwise herein provided. The roof shall be built of fireproof construction. The stairs shall be of fireproof construction, and all door openings must be provided with fireproof thresholds, metal frames and approved incombustible doors. The risers of all stairs shall be not more than eight inches and the tread not less than nine inches, and winders in stairs shall not be permitted. The nearest riser of the stair in a downward direction must be remote from the entrance to the Fire Shield Stairway a distance not less than the width of the stairs. The entrance shall be by a fireproof vestibule or by an outside balcony. Said balcony shall be constructed on private property and shall not encroach on or overhang a public street or alley. Said vestibule or balcony shall be not less than five feet wide and the floors, ceiling and sides thereof shall be of fireproof material. One side of said Fire Shield Stairway shall face a street or alley or an open space leading directly to and connecting with a public street or alley. The side of said vestibule facing the street, alley or other open space, shall be open for the full width thereof from a point four feet above the floor to the underside of ceiling in each story.

The open space above said wall may be enclosed by a fire shield in the following manner only:

A metal frame constructed of steel of commercial shape, or a sheet metal frame filled with concrete, with a horizontal cross piece midway between the top and bottom of said frame, may be fitted in the opening flush with the inside face of the wall. This frame may be hung with two sashes, sash to be of metal and glazed with fire-resisting glass, hinged at the bottom and arranged to open out from the top, and restrained by angle iron or chain attached to the inner part of jambs of the opening, so as to allow sash to rest on same in an open position, in such a manner that the top edge of sash will be flush with the outer face of the wall. The mason work at the head of the wall opening shall be beveled off at an angle of forty-five degrees. The opening and closing of these sashes are to be controlled by a mechanical device to be approved by the Commissioner of Buildings. Where sash exceed five feet in width, intermediate piers of masonry sixteen inches wide by the breadth of wall in thickness may be built,

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SAFETY SERVICE SAVING

and the resulting openings shall be each treated as hereinbefore stated. All metal sash and fire-resisting glass installed shall be subject to specifications and requirements elsewhere contained in this chapter.

The entrance from the building into the Fire Shield Stairway shall be through the vestibule or by means of the balcony only. All openings from the building to the balcony or vestibule and from the balcony or vestibule to the Fire Shield Stairway shall be not less than six feet nor more than seven feet in height and not less than four feet in width, and shall be provided with approved incombustible doors hung in metal frames and may be glazed with fire-resisting glass. In all cases, the floor of the vestibule or balcony, or floor landing of stairs, and the floor of the building containing Fire Shield Stairway shall be at the same level.

Where balconies are used as a means of access from the building to the Fire Shield Stairway, the floors of same shall be solid and built of fireproof material, and shall be of sufficient strength to sustain a load of one hundred pounds per square foot within the safe limits of stress for materials, as elsewhere specified in this chapter. Said balcony on each story shall be provided on the open side with an incombustible enclosure four feet high. There shall be a sufficient number of windows in the wall between the vestibule and stairway, or the doors to stairway shall be fitted with fire-resisting glass of sufficient area to properly light the said Fire Shield Stairway. All window openings shall be equipped with metal frames and sash and fire-resisting glass. The entire stairway, vestibule and balconies on all floors shall be provided with adequate means of illumination by gas or electricity on a separate circuit, and shall be lighted during all the time any part of the building in which they are located is being used after sunset or whenever lighting shall be required. The Fire Shield Stairway shall terminate at a landing on a level with, or not to exceed six inches above the street, alley or other open space on which faces; and access from said landing to said street, alley or other open space, shall be direct by means of an incombustible door or doors equipped with a metal frame and fire-resisting glass, not less than six feet nor more than seven feet in height, and not less than four feet in width. Connection to said Fire Shield Stairway from first floor will not be required if first floor has sufficient exits properly located. All doors to Fire Shield Stairway shall be of the style known as "double acting doors." In buildings other than skeleton construction a slip joint must be provided in the masonry walls between the tower and any wall connecting or abutting thereto, subject to the approval of the Commissioner of Buildings.

Plans in detail, showing the construction and equipment and all other features of a Fire Shield Stairway shall be submitted in addition to the general plan showing the proposed location of same. Such details shall be drawn to an enlarged scale, and shall consist of a typical floor plan, a typical elevation and cross section of one or more stories and other stories which deviate from typical plan, and shall be approved by the Commissioner of Buildings before a permit for construction of same is issued.

(o) In buildings not more than two stories in height one stairway may be omitted if the building is equipped with a three-foot stairway fire escape built as required for fire escapes in this section with counterbalance drop and placed as far as practicable from the remaining stairway.

(p) Where fireproof buildings have a frontage upon public alleys or have courts of an area of not less than 320 square feet, and where such courts lead directly to a public thoroughfare, fire escapes may be erected on such courts or such alleys and shall not be required to be erected upon the street fronts of such buildings. Such fire escapes shall be located as far as possible from stairways in the buildings, and where it is possible to erect the fire escapes on an alley or in a court they may be thus erected subject to the approval of the Commissioner of Buildings.

(q) In fireproof buildings of Class IIa, fire escapes may be located in light courts of fifty feet in the least dimension, having no opening onto a street or alley, but such fire escape must be connected with a stairway of the building at a level no higher than twenty-five feet above finished grade at the building, said stairway to terminate at the first floor level in a public corridor, giving direct egress from the building.

(r) Such fire escapes shall not be considered as part of the width of stairs as defined in Section 878 of this chapter for such buildings unless that portion of the stairway used in connection with the fire escape is increased by the width of the fire escape, from their junction to the ground.

Hospitals two or more stories in height shall be provided with one or more stairway fire escapes not less than 40 inches between handrails. Sliding fire escapes shall have a radius or width of not less than 42 inches. Sliding fire escapes shall not be built on public thoroughfares and shall deposit the person from same not more than twenty-four inches from the surrounding ground, and sliding fire escapes on Class VIII buildings shall be constructed, located and maintained in accordance with the provisions relating to Class VIII.

Wherever stairway fire escapes are considered by this chapter to be the equivalent of an interior stairway or as taking the place of any of the width of stairs, there shall be a door leading to said fire escape from each floor. Such door shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such door shall not be more than 24 inches above the floor and the door shall be as wide as the stairway required on the fire escape. Where the sill is more than 24 inches from the floor, a small stairway shall be built from the floor to the window sill with treads not less than 10 inches wide and risers not more than 9 inches in height.

(s) A stairway fire escape placed on an exterior wall adjacent to a dividing or party wall shall be considered as a stairway fire escape for each building area to which it is adjacent. In such cases there shall be at least one door or window from each building area leading to the fire escape platform, and the width of each such fire escape shall not be less than 36 inches.

(t) All fire escapes shall be located and constructed to conform to the building for which they are respectively intended.

(u) If any building used wholly or in part for the purposes of Class VII be equipped with automatic sprinklers, and be connected with another building similarly used, and distant not less than twenty-five feet and used by the same occupant, by a fireproof bridge or passageway similarly equipped, then each such tier of bridges or passageways shall be held to be equivalent to and take the place of one outside stairway fire escape on each of the buildings so connected.

(See Special Ruling VI, Page 313.)

882 **Stairway Fire Escapes—Fees—Erection of—Location—Component Parts.)** (a) The Commissioner of Buildings and his assistants shall determine upon the location of all stairway fire escapes before erection of same is commenced.

(b) Before the work is commenced a permit shall be obtained from the Commissioner of Buildings for which a fee of $2.00 shall be exacted.

(c) No permit for a stairway fire escape more than twenty-four inches in width shall be granted unless a detailed plan for the fire escape, approved by a licensed architect or a structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said Commissioner.

(d) All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is possible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

(e) Anchors for a platform four feet two inches or less in width shall be made of one inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron with brace; over six feet shall be one and one-half inch square iron with brace. All anchors shall be turned up not less than eight inches at the outside of the platform on which to bolt the post.

(f) Braces shall be the same thickness as the anchors. The spread of the braces shall be the width of the platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of the platform.

(g) Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between buildings and railings. Platforms shall be not less than five feet in length. The frames and crossbars shall be made as provided in this chapter. Platforms shall have clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a stairway fire escape.

(h) All stairway fire escapes for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than 100 people on any one floor, shall be not less than two feet wide between hand rails. Stringers for a 24-inch stairway fire escape shall not be less than 2 inches by ⅜ inch set 1½ inches apart. Where stairway fire escapes and their balconies and supports are designed and constructed in accordance with the provisions of this chapter relating to materials permitted for such stairway fire escapes, balconies and supports, so as to sustain a load of 100 pounds per square foot, they may be built of steel channels, angles, or I-beams, but when so constructed, they shall comply with the provisions of this chapter in all other respects. All stairway fire escapes for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers of people congregate shall not be less than three feet wide in the clear, and all passageways shall not be less than three feet wide in the clear. Stringers for a 36-inch stairway fire escape shall be made of two bars, 3 inches by 5/16 inch, about one inch apart, or 4½ inches by ⅜ inch flat iron, or of steel channels, angles or I-beams; where over 12 feet in length, they shall have anchor and brace in the center. The tread shall be made of one-half inch square steel or iron, corner upwards, not to exceed 1⅝ inches center, riveted at ends to 2 by 7/16 inch flat iron or steel. There shall be not less than four bars to a tread where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length there shall be not less than six bars to a tread; there shall be a truss supporting treads made of bar iron 2 inches by ⅜ of an inch in thickness riveted to bars of treads in center, supported by not less than two inches by seven-sixteenths of an inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees. The rise shall be not more than nine inches and the tread not less than nine inches.

(i) All stairs shall have three bar railings made of one-inch bar iron for top rail, and three-fourths inch bar iron for lower rail, and when such stairs are more than three inches from the wall of the building, there shall be one or more hand rails on the wall side of such stairs.

(j) All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high, measured at right angles with the treads of such fire escapes, and shall have braces on the outside turned upwards and fastened to the frame of the balcony or stairs, which shall be not less than half way up the posts; all stair fire escapes shall extend to the ground either by counterbalance drop or stairs. All ladder fire escapes shall have either extension ladder or counterbalance drop from the first story of said building to the ground or sidewalk. All fire escapes if not continued to the roof shall be equipped with a ladder built in conformity with the specifications for ladder fire escapes contained herein from top story or attic platform to the roof. Their location, material and construction shall be subject to the approval of the Commissioner of Buildings. When cables are used for counterbalance stairs they shall not be less than three-quarters of an inch in size and shall be well oiled or greased when hung up and shall be oiled or greased at least twice a year. All pulleys and cables holding counterbalance drop shall be covered at bracket so as to be protected from snow or ice.

(k) Wherever a stairway fire escape passes a window or door on buildings hereafter erected, the windows or doors shall be of wired glass and shall have metal frames and sash, and whenever such a fire escape passes above a window, door or other opening not fitted with wired glass and metal frames the said fire escape shall be protected on the under side by sheet metal of not less than No. 20 United States gauge opposite such opening and for a distance of three feet on each side thereof. The use of intermediate platforms shall be permitted on all buildings now built or hereafter constructed whenever it is possible by their use to avoid the necessity of stairway fire escapes passing windows. All fire escapes shall be painted with two coats of mineral paint when erected, one at the shop and one upon completion at the building, and they shall be painted at least once every year thereafter.

(l) Wherever it is impossible to erect stairway fire escapes according to the provisions of this chapter, plans shall be submitted to the Commissioner of Buildings showing the location, material and construction of such stairway fire escapes as are proposed to be built before a permit is issued for the same, and if found to be impracticable to locate and construct fire escapes in accordance with the provisions of this chapter and that fire escapes built according to the plan presented would afford safe and practical means of exit from the building on which they are to be placed, then the Commissioner of Buildings may in his discretion approve the same. All such fire escapes shall be inspected by the Com-

William Penn Hotel, Pittsburgh, Pa.

Ford Motor Car Company Assembling Plant, Kansas City, Mo.

missioner of Buildings on their completion and if found to be safe, satisfactory and in compliance with said approved plans, a certificate shall be issued to such effect upon the payment of $2.00 to the City Collector. All fire escapes other than such as it is impossible or impracticable to build in accordance with the provisions of this chapter shall be inspected by the Commissioner of Buildings on their completion, and if found to be in compliance with the provisions of this chapter a certificate shall be issued by the Commissioner of Buildings upon the payment of a fee of $2.00 to the City Collector.

(m) It shall be unlawful for any person, firm or corporation to use any building requiring fire escapes under the terms of this article until the provisions of this article shall have been complied with.

883. **Ladder Fire Escapes—When Permitted.)** Where a building of Class III or VI, not more than four stories in height has two flights of stairs leading from the ground to the top floor of the building and where also each occupant shall have access to at least two separate and distinct stairways located as required by the provisions of this chapter from the top floor to the ground, a ladder fire escape may be used in lieu of the stairway fire escape required herein, where a counter balance drop is placed from the ladder fire escape to the ground.

884. **Specifications for Ladder Fire Escapes.)** (a) All single and double ladder fire escapes hereafter erected shall be in strict accordance with the following provisions:

(b) There shall be not less than three one-inch square wrought iron anchors to every five-foot balcony and not less than six for a twelve-foot balcony. Such anchors shall pass through the wall of the building and be bolted on the inside with a three-fourths by two-inch nut and three and one-half inch iron washer back of the nut, where the wall is not over twenty inches thick; but where the wall is over twenty inches thick anchors shall be inserted at least eight inches into the wall at an angle of thirty-five degrees.

(c) Where a ladder fire escape is permitted by this chapter, the side guards shall be two by three-eighths inch flat iron. All ladder fire escapes shall be seventeen inches or more in width in the clear. No pipe nor rusted or defective material shall be used in the construction of ladder fire escapes. Rungs of ladders shall be of not less than one-half inch square iron with corners upward, so as to give a safe footing. Rungs shall be riveted and shall be constructed with fourteen-inch centers.

(d) The brace for the anchors shall be at least twenty inches spread and shall extend into the wall four inches; no other form of anchor shall be allowed except by special permit from the Commissioner of Buildings.

885. **Balconies — Construction of.)** All balconies hereafter erected shall be either steel or wrought iron and capable of sustaining a weight of one hundred pounds to the square foot. The balcony frame shall be made of not less than two-inch by two-inch by one-fourth inch angle iron which shall be securely riveted together with crossbars every two feet. Such bars shall be punched one-half inch square close to the top of the bar on two inch centers and one-half inch square iron bars shall be forced through the same. The crossbars shall be securely riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be two inch by three-eighths inch. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron and made to conform with the increased dimensions of iron in crossbars; for thirty-six inch balcony or more they shall be two and one-half inch by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of the balcony for the bars to rest upon; provided that such balconies and platforms of buildings of Class IIc may be built as described in Section 482 of this chapter. Such balconies shall have a substantial cast or wrought iron post every three feet bolted to the balcony. No balcony shall have less than three guard rails which shall be of wrought iron or new iron pipe not less than three-fourths inch in diameter and the ends shall be securely anchored to the wall of the building and shall be not less than ten inches on an angle of thirty-five degrees. Where stairway fire escapes and their balconies are designed and constructed in accordance with the provisions of this chapter to sustain a load of one hundred pounds per square foot, they may be built of steel channel angles or I-beams, but in such cases they shall comply with the requirements of this chapter in all other respects.

886. **Stairs and Fire Escapes—Change in Construction.)** No change in the position of any existing fire escape or stairway shall be made, nor shall any change in the position of any stairway or fire escape as shown on approved plans be permitted, unless the written consent of the Commissioner of Buildings shall first have been obtained.

ARTICLE XXI.

Elevators and Their Enclosing Walls.

887. **Elevator—Passenger and Freight—Permit for Construction.)** (a) Before proceeding with the construction or alteration of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, a permit for such construction or alteration shall be obtained from the Commissioner of Buildings either by the owner or agent of the building in which such elevator is to be constructed or in which such alterations are to be made, or by the contractor who is about to construct or alter such elevator.

(b) It shall be unlawful for any such owner, agent, or contractor to permit or allow the construction of any such elevator or the making of such alterations, or to proceed with or in or about any of the work of construction or alteration of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct, or the nature of the alterations to be made and the location of the building or structure in which the same is or are to be placed or made. Such application shall be accompanied with such plans and specifications as shall be necessary to advise and inform said Commissioner of the plan of construction, type of elevator, kind of alterations and the location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected or altered in conformity with the provisions of this chapter, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment of such applicant of a fee of two dollars for each elevator to be constructed, erected or altered, and such fee shall be known as a permit fee and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed, or of any alterations made.

888. **Fee.)** All contractors or persons, firms, or corporations, engaged in the manu-

facture and work of installing iron doors on passenger or freight elevators, or of installing wire work enclosures around elevators, shall secure a permit from the Commissioner of Buildings for the work on each such elevator, the fee for which shall be two dollars for each elevator in buildings of four stories or less in height, and in buildings of more than four stories in height fifty cents additional shall be charged on each elevator for every additional floor in excess of such four stories.

889. **Unlawful to Proceed Without Permit.)** It shall be unlawful for any person, firm or corporation either as owner, lessee, contractor or agent of any building or structure in which any elevator or elevators are to be constructed or altered to proceed with said work without securing a permit as herein required for such construction or alteration, and no such permit shall be issued until such person, firm or corporation, lessee, contractor or agent shall have complied with all the requirements of this chapter.

890. **Inclosure of Elevator Shafts in Non-Fireproof Buildings.)** In all non-fireproof buildings erected after March 13, 1911, all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such inclosure shall extend from the foundation to the roof of such building, and shall be supported independently of the floor construction; provided, however, that the requirements of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Chief of Fire Prevention and Public Safety.

891. **Inclosure of Pits and Shafts in Basements.)** In all buildings heretofore or hereafter erected, not included in Section 890, whenever any elevator shaft extends down into a basment or sub-basement, that portion thereof extending below the level of the floor of the first story shall be inclosed in walls of brick, tile or other fireproof material, and the door openings in such enclosure shall be protected by incombustible doors. Where such elevator shafts do not extend down into the basement they shall be provided with fireproof pits at the lowermost floor level above which they serve, and such pits shall have no openings except for cables or other elevator equipment.

892. **Inclosure of Dumb Waiter Shafts—Materials.)** In all non-fireproof buildings hereafter erected, the dumb waiter shafts shall be inclosed with brick, tile, reinforced concrete, or cement plaster not less than two inches thick or metal studs and lath.

893. **Doors—On Elevators.)** In all elevator shafts which are herein required to be enclosed with fireproof walls, the door openings shall be equipped with doors of incombustible material, which shall be made to open from the outside by means of a key or other device satisfactory to the Commissioner of Buildings.

894. **Hatch Doors — Freight Elevators.)** Elevators, used exclusively as freight elevators constructed and in operation at the time of the passage of this ordinance need not have enclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds 140 degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of a building in which such elevator is maintained to keep such hatch closers or doors at all times in good working order. Such automatic hatch closers shall be examined by the Commissioner of Buildings and the Chief of Fire Inspection and Public Safety, and if said officials shall find that such doors will automatically close when the temperature at or near such doors exceeds 140 degrees Fahrenheit, and that the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order and failing to operate when required, and that in their construction or operation there is nothing that is likely to cause accidents or to interfere with the elevator service in such hatch holes which they were intended to close, and that the building in which such freight elevator is in use is equipped with stairways, fire escapes and passenger elevators sufficient to offer ample means of escape from such building in case of fire, for all persons employed or for all persons in such building, then, and in such case only, shall the use of such hatch doors or closers be permitted. All freight elevators in non-fireproof buildings shall comply with the preceding requirements of this section, or shall have inclosing walls of incombustible or fireproof construction. Such elevators are to be inspected semi-annually and oftener when, in the opinion of the Commissioner of Buildings, such inspection is necessary and such fees shall be paid for said inspection as otherwise provided in said chapter.

895. **Safety Device.)** (a) Every passenger and freight elevator now in operation or hereafter installed, except such as are hereinafter exempted from the provisions of this chapter, shall be provided with a speed governor and such other efficient device to secure the safe operation of such passenger or freight elevator, and to prevent the cab or car of such elevator from falling, and to secure the safety of the cab or car and its load in case it does fail, as may be required by the Commissioner of Buildings. Such speed governor and other devices shall be subjected to such a practical test as may be determined by the Commissioner of Buildings for the purpose of ascertaining the efficiency of such safety device.

(b) It shall be the duty of the Commissioner of Buildings to make such test of each and every device upon all elevators, and no elevator shall be permitted to be run until such test has been made.

(c) Whenever any accident shall occur causing injury to life or limb to any person, in or about an elevator, or while getting on or off an elevator, or which shall in any way impair the safety of the elevator, such accident shall be reported at once by the owner, superintendent, lessee or manager of the building, or the operator of the elevator, to the Commissioner of Buildings. No broken or damaged parts of such elevator shall be moved or displaced, nor shall repairs be made thereon, nor shall said elevator be operated until an investigation into such accident has been made by the Commissioner of Buildings or his duly authorized agent. A full report in writing of the result of such invetigation shall be filed in the Department of Buildings, and the Commissioner of Buildings shall keep a complete record of all such accidents and reports thereon.

(d) It shall be unlawful for any operator of any elevator in the City wherein passengers are conveyed to start such elevator until all doors of such elevator and leading into such elevator shall be closed. It shall be unlawful for any such operator to open any of the doors of such elevator until said elevator has come to a full stop.

(e) Any person, firm or corporation violating any of the provisions of this section, or failing or neglecting to comply therewith,

shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

896. **Safeguards for Elevators.)** (a) Where the counterweights travel in the same hatchway with an elevator car, the portion of the car contiguous to the weights shall be protected from the top to the bottom of the car by a suitable guard.

(b) All freight elevators shall be provided with a guard at least six feet high. All elevator cabs or cars, whether used for freight or passengers, shall be provided with some device whereby the car or cab may be held in the event of accident to the shipper rope or hoisting machinery or controlling apparatus.

(c) No passenger elevator hereafter erected shall be installed with a freight compartment either below or above the car.

(d) All hoistways, hatchways, elevator wells and wheel holes in any building, whether occupied or vacant, shall be securely fenced, inclosed or otherwise safely protected, and it shall be the duty of the owner, occupant or agent of any such building to keep all such means of protection closed at all times, except when it is necessary to have the same open, in order that the said hatchways, elevators or hoisting apparatus may be used.

(e) It shall be unlawful to erect or maintain an elevator where such elevator or its counterweight descends into any passageway or thoroughfare.

(f) There shall be directly under the sheaves at the top of every elevator hatchway, a grating of steel or heavy wire mesh properly supported by steel or iron and capable of sustaining a load of not less than 500 pounds.

(g) All counterweights hereafter installed shall have their component parts so fastened together as to prevent any piece or pieces from becoming detached from the guides should the counterweights be accidentally drawn to the top of the hatchway.

(h) Where drum counterweight cables run through or pass by the car counterweights to weights underneath, they shall be provided with a suitable covering to prevent their chafing and wearing on the counterweights.

(i) Where elevators other than handhoists and sidewalk elevators are not inclosed with fireproof or incombustible material, as is elsewhere herein specified in this Article, the well-hole of such elevator shall be enclosed with a wire guard not less than six feet high. The counterweights and the immediate space through which they travel must be protected from the floor to the ceiling with a wire guard or with other incombustible material. There must be on all elevators hereafter constructed a clear space of not less than two feet between the bottom of the hatchway and the level of the lower floor landing when the car is at its lowest position, and there must be a clearance of at least four feet from the top of the crossbeam of the car to the lower side of the grating under the overhead sheaves. Whenever there is conflict in regard to the manner of enclosing any elevator shaft or portion thereof between this section and Sections 890, 891 and 892, the provisions of the latter sections shall prevail.

(j) All passenger and freight elevators hereafter installed, except sidewalk or hand elevators, shall have an artificial traveling gas or electric light attached to the car and maintained in good working condition.

(k) All power driven elevators hereafter constructed or installed shall have at least two hoisting cables for the cage and two cables for each counterweight. The lifting and counterweight cables shall have at least one full turn of the cable on the drum when the car has run its limit.

(l) It shall be unlawful to change a hand-hoist to a power-driven elevator without first making application to the Commissioner of Buildings for a permit for such change, and it shall be unlawful to connect an electric motor or any other appliance to the hand elevator machinery without the approval of the Commissioner of Buildings.

(m) All elevators, except hand elevators operated by a pulley rope and sidewalk ram or chain hoist elevators, and elevators used in tunnels for freight service only, shall be equipped with a safety speed governor.

(n) Where ropes or cables are used to operate safety devices, a weight shall be properly attached to the same in such a manner as to insure the necessary tension on such rope or cables for proper performance of the safety devices.

(o) All elevators propelled by electricity shall be provided with an additional device not operated by link or sprocket chain which will automatically stop the elevator machinery when the car has reached its limit of travel. It shall be unlawful to construct or maintain any elevator equipped with a sprocket chain or link belt device or devices connecting the operating device and controller.

(p) An emergency switch which will disconnect the current shall be provided in all passenger elevators hereafter installed which are operated by an electric controller car switch, and such cars shall be so constructed that they will automatically stop when the current is disconnected.

(q) The underside of the floors or other parts of a building which project into passenger elevator shafts shall be equipped with a smooth steel guard curved and sloped from the enclosure of said elevator to the edge of such projection for the width of the door to such elevator car and the slope of the guard plate shall not be less than sixty degrees with the horizon.

(r) The provisions of this section requiring the equipment of elevators with safety devices shall not apply to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction, but the Commissioner of Buildings shall make such reasonable requirements as he may deem necessary for public safety in the operation of such hand hoists, elevators or hoists used solely for hoisting materials or tools in such buildings while under construction.

897. **Inspection—Test—Certificate to Be Posted.)** (a) Every elevator now in operation or which may be hereafter installed, together with the hoistway and all equipment thereof, shall be inspected under and by the authority of the Commissioner of Buildings at least once every six months, and in no case shall any new elevator be placed in operation until an inspection of the same has been made.

(b) It shall be the duty of every owner or agent, lessee or occupant of any building wherein any elevator is installed and the person in charge or control of any elevator to permit the making of a test and inspection of such elevator or elevators and all devices used in connection therewith upon demand being made by the Commissioner of Buildings or by a duly authorized Elevator Inspector within five days after such demand has been made.

(c) Whenever any such elevator has been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped and the result of such inspection and tests shows such elevator to be in good condition, satisfactory to the Commissioner

of Buildings, and that such safety devices have been provided in accordance with the requirements of this chapter and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings to issue or cause to be issued a certificate setting forth the result of such inspection and tests and containing the date of inspection, the weight which the elevator will safely carry and a statement to the effect that the shaft doors, hoistway and all equipment, including safety devices, are constructed in accordance with the provisions of this chapter, upon the payment of the inspection fee required by this chapter.

(d) It shall be the joint duty of the owner, agent, lessee or occupant of the building in which such elevator is located and of each person in charge or control of such elevator to frame the certificate and place same in a conspicuous place in each elevator.

(e) The words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

(f) Where the result of such inspection or tests shall show such elevator to be in an unsafe condition or in bad repair, or shall show that the safety devices, or any of them, which are required by this chapter, have not been installed, or if installed, are not in good working order or not in good repair, such certificate shall not be issued until such elevator, its hoistway and its equipment or such device or devices shall have been put in good working order, satisfactory to the Commissioner of Buildings. The inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

898. **Power of Commissioner to Stop Operation of Elevators.)** (a) Whenever any building or elevator inspector finds any passenger or freight elevator or any of its running parts or automatic devices or other equipment out of order, or in an unsafe condition, he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

(b) It shall be the duty of the Commissioner of Buildings upon receiving from any inspector a report of the unsafe condition of any elevator, to order the operation of such elevator to be stopped, and to cause such elevator not to be used until the same shall have been placed in a safe condition, and it shall be unlawful for any owner, agent, lessee, or occupant of any building, wherein any such passenger or freight elevator is located within the city, to permit or allow any such elevator to be used after the receipt of a notice in writing from the Commissioner of Buildings that any such elevator is out of order or is in an unsafe condition and until said elevator has been put in a safe and proper condition as required by the provisions of this chapter.

ARTICLE XXII.

Building Contractors.

899. **Building Contractors—Registry with Department of Building.)** That every person, firm, or corporation engaged in the business of constructing or repairing the whole or any part of buildings or the appurtenances thereto in the City of Chicago, shall before undertaking the erection, enlargement, alteration, repair or removal of any building, for which permits are required by the ordinances of the City, register the name and address of such person, firm, or corporation in a book kept by the Commissioner of Buildings and used for this purpose.

No permit shall be granted for the erection, enlargement, alteration, repair or removal of any building unless the name and address of the person, firm, or corporation that is about to undertake the work of construction on such buildings is contained in the registration book kept for that purpose.

900. **Where Masonry Work Only is Required.)** When application is made for a permit and the work of construction involves masonry construction only the above provisions shall not apply to any person, firm or corporation licensed as a mason contractor or employing mason as provided in and by the ordinances of the City. Where the work of construction, for which a permit is sought involves construction other than masonry construction, any mason contractor or employing mason, licensed as aforesaid, engaged in or undertaking the work of such construction other than masonry construction must register his, their or its name or names and comply with the other requirements of this article before a permit for such work is issued.

901. **Liability for Violations.)** If any person, firm or corporation that is so registered shall fail, in the execution of any work for which a permit was issued, to comply with the ordinances of the City relative to the erection, enlargement, alteration, repair or removal of any building, either the Commissioner of Buildings or the Commissioner of Health may bring suit and prosecute such person, firm or corporation for such failure or violation, and in case of conviction, his, their or its name or names shall be stricken from the said registration book and shall not be re-entered or reinstated during such time as any violation exists or any judgment remains unsatisfied with regard to said conviction.

902. **Reinstatements.)** Any person, firm or corporation that shall have been convicted under the preceding section and had his, their, or its name or names stricken from such registration book may have such name or names re-entered on filing with the Commissioner of Buildings a certificate signed by the City Prosecutor, the Commissioner of Buildings and the Commissioner of Health to the effect that all violations of ordinance with reference to which conviction was secured, have been corrected and are non-existent and that all claims and judgments arising from such convictions have been paid.

ARTICLE XXIII.

Billboards, Signboards, Signs, and Fences.

903. **Billboards and Signboards on Buildings—Construction—Height.)** No billboard or signboard shall be erected or placed upon or above the roof of any building or structure within the limits of the City of Chicago; and it shall be unlawful for any person, firm or corporation to attach any billboard or signboard to the front, sides, or rear walls of any building, unless the same shall be placed flat against the surface of the building and safely and securely anchored or fastened thereto in a manner satisfactory to the Commissioner of Buildings.

904. **Size and Construction of Billboards and Signboards Erected Within Fire Limits Otherwise Than on Buildings.)** The face of billboards or signboards erected within the fire limits as now defined or as they may hereafter be defined by ordinances of the City of Chicago other than signboards and billboards referred to in Section 906 hereof, shall not exceed twelve feet in height, and the same shall be constructed of galvanized iron or some other equally incombustible material, except that the stringers, uprights and braces thereof may be of wood. All such billboards or signboards shall be securely anchored or fastened so as to be safe and substantial.

905. **Height and Distance From the Ground of Billboards and Signboards Erected Within the Fire Limits.)** It shall be unlawful for any person, firm or corporation to construct or erect any billboard or signboard, except those specified in Section 906 hereof, within the fire limits of the City of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street or streets has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The face of every billboard or signboard within the fire limits shall be of incombustible material, but the supports and framework of the same shall be of wood. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. Every such billboard or signboard must be constructed and located in accordance with the provisions of this Article and shall be subject to the approval of the Commissioner of Buildings.

906. **Wooden Billboards or Signboards—Construction—Size—Exceptions.)** Billboards or signboards not exceeding twenty-four (24) square feet in area when attached to the front, sides, or rear walls of any building, so that the flat surface of same is against the building, or when erected on the ground, if not erected nearer than ten feet to any building, structure, other signboard or public sidewalk, which are used to advertise the sale or lease of the property upon which they shall be erected, may be built of wood or other combustible material, and such billboards or signboards shall be exempt from the provisions of this article, except that they shall be safely and securely anchored or fastened and shall be so constructed, anchored and fastened that they will withstand the wind pressure specified in Section 911 of this Article. It shall be unlawful to erect any such billboard or signboard exceeding twenty-four (24) square feet in area before a permit therefor has been procured from the Commissioner of Buildings, the application for which must include the plans and specifications of such board and its supports and fastenings.

907. **Billboards and Signboards Erected Outside the Fire Limits—Construction—Size.)** It shall be unlawful for any person, firm or corporation to construct, erect or locate any billboard or signboard, except those specified in Section 906 hereof, outside the fire limits of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. The braces, supports and face of the billboard or signboard outside the fire limits may be made of wood, unless the billboard or signboard shall be erected or located so that any part of the face of said board is nearer than ten feet to any building or structure in which case the face of the same shall be constructed with incombustible material. Every such billboard or signboard shall be safely and securely constructed, anchored, fastened and located in accordance with the provisions of this article and shall be subject to the approval of the Commissioner of Buildings.

908. **Provisions of This Article Shall Apply to Other Similar Structures.)** The provisions of this article shall apply to other similar structures of like size and construction without regard to their use whether erected on or near the surface of the ground or anchored to, or fastened to any building or structure.

909. **No Billboard or Signboard Shall be Erected Without Permit.)** No billboard or signboard or other similar structure such as is described in this article shall be erected or maintained within the city unless a permit shall first have been secured by the person, firm or corporation desiring to erect or maintain such billboard or signboard from the Commissioner of Buildings to whom application for such permit shall be made; and such application shall be accompanied by such plans and specifications of the proposed billboard or signboard and location of same as are necessary to fully advise and acquaint the said Commissioner with the construction of such proposed billboard or signboard. If the plans and specifications accompanying such application shall be in accordance with the provisions of this article, said Commissioner shall thereupon issue a permit for the erection of such billboard or signboard upon the payment by the applicant of a fee as hereinafter fixed.

910. **Alteration and Repair of Billboards and Signboards.)** No material alteration of any billboard or signboard nor removal from one location to another shall be made except upon a written permit issued by the Commissioner of Buildings authorizing such alteration or removal; and such permit shall be issued upon application in writing made to such Commissioner by the owner of such billboard or signboard or by the person in charge, possession or control thereof, accompanied by a plan of the proposed alterations or repairs to be made and a written statement covering the proposed removal from one location to another and its reconstruction in the new location, which said alteration and repairs or removal shall be made in accordance with the provisions of this article and the ordinances of the City of Chicago. Where such plans, specifications and location are in compliance with the requirements of this article and are satisfactory to and approved by the Commissioner of Buildings, such Commissioner shall issue a permit upon the payment of a fee therefor as hereinafter fixed; but such alteration shall not be construed to apply to the changing of any advertising matter of any billboard or signboard, nor the refacing of the framework supporting same.

911. **Wind Pressure—Strength.)** All billboards and signboards now in existence, or hereafter to be constructed, erected or maintained, shall be made, constructed, erected and maintained of sufficient strength to withstand a wind pressure of twenty-five pounds per square foot of surface without stressing the material beyond the safe limit of stress given elsewhere in this chapter.

912. **Changes in Existing Billboard and Signboards.)** No surface billboard or signboard constructed or erected prior to the passage of this ordinance shall be maintained after six months from and after the passage of this ordinance where the height of such billboard or signboard exceeds seventeen feet,

nor shall such billboard or signboard be maintained after such date, unless there is a clear space of at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is erected or maintained is above the level of the street there must be a clear space of at least three feet between the bottom or face of the billboard or signboard and the level of the ground at the point where the billboard or signboard is erected or maintained.

913. **Duty of Commissioner—Owner's Name to Be Placed on Top of Billboard or Signboard—Annual Inspection.)** It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or signboard and to approve same if the method of construction and provisions made for fastening, securing, anchoring and maintaining such billboard or signboards are such as will serve to protect the public and to render such billboards safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise supervision over all billboards and signboards erected or being maintained under the provisions of this article; and to cause inspection by inspectors in his department of all such billboards and signboards to be made once each year and oftener where the condition of such boards so require; and whenever it shall appear to said Commissioner that any such billboard or signboard has been erected in violation of this article or is in an unsafe condition or has become unstable or insecure or is in such a condition as to be a menace to the safety or health of the public, he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or signboard or person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person, firm or corporation of the violation of this article and the dangerous condition of such billboard or signboard and directing him to make such alterations or repairs thereto, or to do such acts or things. as are necessary or advisable to place such billboard or signboard in a safe, substantial and secure condition and to make the same comply with the requirements of this article within such reasonable time as may be stated in said notice. If the owner or person in charge, possession or control of any billboard or signboard when so notified shall refuse, fail, or neglect to comply with and conform to the requirements of such notice, said Commissioner shall, upon the expiration of the time therein mentioned, alter, change, tear down or cause to be torn down such part of such billboard or signboard as is constructed and maintained in violation of this article, and shall charge the expense to the owner or person in possession, charge or control of such billboard or signboard and the same shall be recovered from such owner or person by appropriate legal proceedings. If the owner of such billboard or signboard or the person in charge, possession or control thereof cannot be found, or his or their whereabouts cannot be ascertained, the Commissioner shall attach or cause to be attached to said billboard or signboard, a notice of the same import as that required to be sent to the owner or person in charge, possession or control thereof, where the owner is known; and if such billboard or signboard shall not have been made to conform to this ordinance and be placed in a secure, safe and substantial condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or signboard, it shall be the duty of the Commissioner of Buildings to thereupon cause such billboard or signboard or such portion thereof as is constructed and maintained in violation of this article to be torn down; provided that nothing herein contained shall prevent the Commissioner of Buildings from adopting such precautionary measure as may be necessary or advisable in case of imminent danger in order to place such billboard or signboard in a safe condition, the expense of which shall be charged to and recovered from the owner of such billboard or signboard or person in charge, possession or control thereof in any appropriate proceedings therefor. No permit shall be issued to any applicant for permission to erect a billboard or signboard unless such applicant shall agree to place and maintain on the top of such billboard or signboard the name of the person or corporation owning same or who is in charge, possession or control thereof. It shall be the duty of the Commissioner of Buildings to require that the name of the person or corporation owning or in possession, charge or control of such billboard or signboard is placed upon such billboard or signboard forthwith upon the erection thereof and is kept thereon at all times such billboard or signboard is maintained; and in case the owner of such billboard or signboard or the person in charge, possession or control thereof shall fail or refuse to place and maintain such name on the same, such owner or person shall be subject to the penalty hereinafter provided for. Every person, firm or corporation engaged in the business of erecting billboards or signboards for the purpose of display advertising shall file with the Commissioner of Buildings within ninety days after the passage of this ordinance a full and complete report of the location and size of all existing billboards or signboards unless such record is already in the possession of the Commissioner of Buildings.

914. **Fees for Permits and Annual Inspection—Indemnifying Bond.)** (a) The fee to be charged for permits issued for the erection or construction of billboards or signboards or for the alteration thereof shall be five dollars for each twenty-five lineal feet of billboard or signboard erected or altered. An annual fee of one dollar for each twenty-five lineal feet of billboard or signboard, or fractional part thereof shall be charged every person, firm or corporation as owner, or in possession, charge or control of any billboard or signboard for inspection of such billboards or signboards; provided, however, that where such signboard does not exceed sixty-five square feet in area and is attached to the surface of a permanent building in accordance with the provisions of Section 903 and is designed to give publicity to the business carried on within such building, and no part of said sign is more than eighteen feet above the average inside grade at the front of the building, no fees for erection or inspection shall be charged; but not more than one sign of sixty-five square feet shall be allowed for each twenty-five lineal feet of frontage, unless the fees for erection and inspection are paid as herein provided for.

(b) Every person, firm or corporation engaged in the business of constructing and erecting billboards or signboards shall file with the City Clerk a bond, with sureties to be approved by the Commissioner of Buildings, in the penal sum of twenty-five thousand ($25,000.00) dollars, conditioned that such person, firm or corporation shall faithfully comply with all the provisions and requirements of this article with respect to the construction, alteration, location and safety of billboards or signboards and for the payment of the inspection fees required by this article; and conditioned, further, to indemnify, save and keep harmless said City of Chicago and its officials from any and all claims, damages, liabilities, losses, actions, suits or judgments which may be presented, sustained, brought or secured

against the City of Chicago or any of its officials on account of the construction, maintenance, alteration or removal of any of said billboards or signboards, or by reason of any accidents caused by or resulting therefrom.

915. **Frontage Consents Required.)** It shall be unlawful for any person, firm or corporation to erect or construct any billboard or signboard in any block on any public street in which one-half of the buildings on both sides of the street are used exclusively for residence purposes without first obtaining the consent in writing of the owners or duly authorized agents of said owners owning a majority of the frontage of the property on both sides of the street in the block in which such billboard or signboard is to be erected, constructed or located. Such written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the erection, construction or location of such billboard or signboard.

916. **Penalty.)** Any person, firm or corporation owning, operating, maintaining or in charge, possession or control of any billboard or signboard within the city, who shall neglect or refuse to comply with the provisions of this article, or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this article in all cases where no specific penalty is fixed herein, shall be fined not less than twenty-five ($25.00) dollars nor more than two hundred ($200.00) dollars for each offense; and each day on which such person shall permit or allow any billboard or signboard owned, operated, maintained or controlled by him to be erected, constructed or maintained in violation of any of the provisions of this article shall constitute a separate and distinct offense.

917. **Fences—Permit Fee.)** It shall be unlawful for any person, firm or corporation to erect or construct any fence within the city limits without first obtaining a permit from the Commissioner of Buildings. No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. The fee to be charged for permits for the erection or construction of fences shall be one dollar for each one hundred lineal feet of fence.

(See Special Ruling VII, Page 313.)

918. **Fences—Walls—Height of—Wind Resistance.)** No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. No fence of any other material shall be constructed on a lot alongside a street or alley or within eight feet of such street or alley and parallel thereto of greater height than eight feet above the surface of th street or alley where a grade is established or eight feet above the surface of the street or alley where no grade is established. No single or isolated wall of any material whatever, which forms no part of a building or structure that may be lawfully erected, shall be constructed upon any portion of a lot where the distance from such wall to the lot line is less than the height of the wall, unless such isolated wall shall have lateral supports on at least one side of same with braces extending to the top of the wall and is so constructed that it shall be capable of resisting a horizontal wind pressure on every part of same twice as great as buildings under the provisions of this ordinance must be designed to resist.

In all cases where a fence or wall has been or shall hereafter be erected contrary to the provisions of this section, the Commissioner of Buildings shall forthwith notify the owner or agent of the land on which same is located, or the contractor engaged in erecting same, and shall specify briefly in such notice in what manner such fence or wall violates the provisions of this section, and the said Commissioner of Buildings shall require the person so notified to forthwith make such fence or wall conform to and comply with the provisions of this section, specifying in such notice the time within which such work shall be done.

If at the expiration of the time set forth in the notice provided for in this section, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and shall not have torn down or changed the said fence or wall so as to conform to and comply with the provisions of this section, the Commissioner of Building shall have authority and it shall be his duty to proceed forthwith to tear down, or cause to be torn down, such fence or wall or so much thereof as is being maintained or shall have been erected and constructed in violation of the provisions of this section, and the cost of such tearing down shall be charged to and recovered from the owner of such fence or wall or from the person for whom such fence or wall have been or is being erected.

919. **Illuminated and Other Roof Signs of Steel Skeleton Construction—Definition—General Requirements — Fees.)** (a) Illuminated and other roof signs regulated by this section shall be defined as signs constructed, erected and maintained upon or over the roof of any building which have all or any part of its letters of which said signs may be constructed either in an outline of incandescent lamps or which have painted, flush or raised letters where the face of the sign presents a surface to be affected by wind pressure not in excess of the requirements hereinafter contained; or signs having a border of incandescent lights attached thereto and reflecting light thereon; or transparent glass signs where they are lighted by electricity or other illuminant. Every such sign as hereinabove described shall be constructed with steel skeleton construction so as to present a surface to be affected by wind pressure which shall not exceed fifty per cent. of the face of the sign. No illuminated roof sign shall be erected or maintained upon or over the roof of any building unless the framework thereof shall be entirely of metal or some other equally incombustible material, and no material, except such material as is used for insulating wires and conductors, which is less combustible than metal, shall be used in, on or about, or comprise a part of any illuminated roof sign, except that the material to which the framework of any such sign shall be anchored, may be substantial beams anchored or securely fastened to the roof or walls of the buildings upon or over which any such sign is erected.

(b) The distance between the roof of said building or structure and the lower edge of such sign shall not be less than five (5) feet. The height of any such sign from the roof of the building or structure to which the same is anchored or attached shall not exceed sixty (60) feet. No such sign, hereafter erected, shall be constructed closer than six (6) feet from the edge of the roof of the building or structure upon which same is erected. No such illuminated roof sign shall be constructed on any building or structure which is over eight stories in height. In case of illuminated roof signs less than twelve (12) feet in height, the permit fees and inspection fees shall be the same as for billboards, and signboards and the provisions for such fees in this section shall not apply. No illuminated roof sign, such as is described in this section, sha'l be constructed, erected, maintained or put in

place until the person, firm or corporation desiring to construct, erect, maintain or put in place such sign shall have made application in writing to the Commissioner of Buildings for permission so to do, submitting with such application plans and specifications showing the size, nature and construction of the sign proposed to be erected, and shall present to the City Electrician plans showing the insulation, location and construction of the electrical part of such sign. If the Commissioner of Buildings shall be of the opinion that such sign, if erected, constructed and maintained in accordance with the plans and specifications so submitted, shall be safe and secure, he shall approve the application so submitted, providing the plans bear the approval of the City Electrician, and the Commissioner of Buildings shall note his approval upon such plans and specifications and keep a copy thereof at all times on file in his office. All signs shall be constructed, erected and maintained of sufficient strength to withstand a wind pressure of not less than thirty pounds per square foot of surface without stressing the material beyond the safe limits of stress given else where in this chapter. It shall be the duty of the Commissioner of Buildings to cause his building inspector or inspectors to make an inspection annually of each illuminated roof sign erected or constructed or being maintained under the provisions of this ordinance for the purpose of ascertaining whether such sign is safely and securely constructed and so anchored and fastened to the building or structure; provided, however, that the provisions of this section shall not apply to the erection, construction and maintenance of signboards and billboards as regulated by the ordinances of the City of Chicago.

(c) Any person, firm or corporation desiring to erect or maintain an illuminated roof sign, as described in this section, shall pay to the city, to cover the cost of inspection and approval by the Commissioner of Buildings of the plans and specifications of such sign, when erected, a fee of fifty dollars for the first five hundred square feet of superficial area of such sign or fractional part thereof, and five cents for each additional square foot. For each annual inspection of any illuminated roof sign by the Commissioner of Buildings, subsequent to the first inspection, there shall be paid a fee of fifty dollars for the first five hundred square feet or fractional part; five cents additional for each additional square foot area over five hundred square feet. In addition to the fees herein required to be paid for inspection, there shall be paid by the owner or person having charge or control of any illuminated roof sign, as herein described, an annual inspection fee to cover the cost of such inspection, which shall be made by the Commissioner of Gas and Electricity, whose duty it shall be to cause such annual inspection to be made, and such fee shall be at the rate provided by the ordinances of the city.

(d) Every illuminated roof sign erected, constructed or maintained under the provisions of this ordinance shall have the name of the owner thereof placed thereon in a legible and conspicuous manner. No person, firm or corporation shall be permitted to erect or maintain an illuminated roof sign unless he shall execute and file with the City Clerk of Chicago, with sureties to be approved by the Commissioner of Buildings, a bond to the City of Chicago in the penal sum of fifteen thousand dollars ($15,000.00), conditioned to indemnify, save and keep harmless the City of Chicago, and its officers and agents, from any damage which it, the said city, or any of said officers, may suffer, or from any costs, liability or expense of any kind whatsoever which it, the said city, or any of its officers, may be put to or which may be recovered against the said city, or any of its officers, from or by reason of the construction, erection and maintenance of such sign, and conditional further to faithfully observe and perform all the provisions and conditions of this article and of any ordinance now in force or which may hereafter be passed by the City Council of the City of Chicago, relating to or governing the erection, maintenance, use or inspection of illuminated roof signs.

(e) The permission and authority granted by this article shall cease at any time hereafter at the discretion of the Mayor. In case of the termination of the priviliges herein granted by the exercise of the Mayor's discretion as aforesaid, all such electrical signs erected by virtue of the authority conferred by this article, shall be removed at the expense of the owner or owners of the building or the person, firm, corporation or individual who are then maintaining same without any cost or expense of any kind whatsoever to the City of Chicago, provided that in the event of the failure, neglect or refusal on the part of the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating and maintaining said electric sign to remove said electric sign upon the revocation of the permit by the Mayor as herein provided, the Commissioner of Buildings may proceed to remove same and charge the expense thereof to the owner of the building or structure upon which said illuminated electric sign is constructed or to the person, firm, corporation or individual operating or maintaining same.

(f) Any person, firm or corporation who shall erect, construct or maintain an illuminated roof sign in violation of any of the provisions of this section shall be fined not less than fifty dollars ($50.00) nor more than two hundred dollars ($200.00) for each offense.

ARTICLE XXIV.

Frontage Consents.

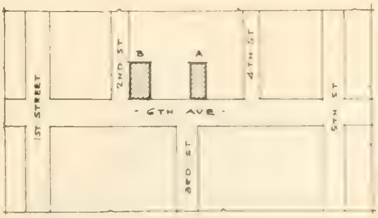

Fig. 52.

920. **Definition of Word "Block.")** Whenever a provision is made in this chapter that frontage consents shall be obtained for the erection, construction, alteration, enlargement or maintenance of any building or structure in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specially provided.

921. **Frontage Consents—Where Required—Uses of Property for Required—Consent in Writing.)** It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain on any lot fronting on any street or alley in the City in any block in which one-half of the buildings on both sides of the street are used exclusively for residence purposes, or within fifty feet of any such street, any building, structure or place used for a gas reservoir, manufacture of gas, stock yards, slaughter house, packing house, smoke house or place

where fish or meats are smoked or cured, soap factory, glue factory, size or gelatine manufactory, renderies, fertilizer manufactory, tannery, storing or scraping of raw hides or skins, lime kiln, cement or plaster of Paris manufactory, oil cloth or linoleum manufactory, rubber manufacture from the crude material, saw or planing mill, wood working establishment, starch factory, glucose or dextrine manufactory, textile factory laundry run by machinery, factory combined with a foundry, iron or steel works, brass or copper works, sheet metal works, blacksmithing or horseshoeing shop, boiler making, foundry, smelter, metal refinery, machine shop, stone or monument works run by machinery, asphalt manufacture or refining, paint and varnish factory, oil or turpentine factory, printing ink factory, tar distillation or manufacture, tar roofing, tar paper or tarred fabric manufactory, ammonia or chlorine or bleaching powder factory, celluloid manufactory, place for the distillation of wood or bones, lamp black factory, sulphurous acid, sulphuric acid, nitric or hydrochloric acid manufacture, factories or other manufacturing establishments using machinery or emitting offensive or noxious fumes, odors or noises, storage warehouses storing or baling of junk or scrap paper or rags, shoddy manufacture or wool scouring, second-hand store or yard, incineration or reduction of garbage or offal, dead animals or refuse, stable for more than five horses, medical dispensary, livery stable, sale stable, boarding stable, without the written consent of a majority of the property owners according to frontage on both sides of such street or alley. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building, structure or place for any of the above purposes: provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street located upon a corner lot shall not be considered.

922. **Reformatories — Sheltering Institutions.)** It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which one-half of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution or the grounds thereof may have frontage, are used exclusively for residence purposes without the written consent of a majority of the property owners, according to frontage on both sides of the streets bounding such square. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction, alteration, or maintenance of such building. Provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

923. **Permit For Moving Frame Buildings — Requirements — Written Consents — Space Occupied on lot.)** (a) No person, firm or corporation shall be permitted to move any building which has been damaged to an extent greater than 50 per cent of its value by fire, decay or otherwise; nor shall be permitted to move any frame building of such character as is prohibited to be constructed within the fire limits from any point outside the fire limits to any point within the fire limits; nor shall it be permissible to move any building to a location at which the uses for which such building is designed are prohibited by ordinance. Permits for the moving of frame buildings other than those the moving of which is herein prohibited, shall be granted upon the payment of a fee of ten cents for each one thousand cubic feet of volume or fractional part thereof of such building, and securing and filing the written consent of two-thirds of the property owners according to frontage on both sides of the street in the block in which such building is to be moved. No permit shall be issued to move any building used or designed to be used for purposes for which frontage consents are required until frontage consents in the block to which such building is to be moved have also been secured and filed as required by the ordinances relating to such use.

(b) No building used for residence or tenement house purposes shall be moved from one lot to another or from one location to another upon the same lot unless the space to be occupied on such lot shall comply with the provisions of Section 642 of this chapter.

(c) No frontage consent shall be required of any person, firm or corporation for removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

924. **Amusements — Frontage Consents Required.)** It shall be unlawful for any person, firm or corporation to construct or erect any building or structure designed or intended to be used for the purpose of presenting or carrying on therein any entertainment for which a license is required by the ordinances of the City of Chicago or to devote any grounds or place to such purposes without first obtaining the written consent of the property owners as required by the City ordinances.

925. **Buildings for the Storage of Shavings, Sawdust and Excelsior—Frontage Consents.)** It shall be unlawful for any person, firm or corporation to construct or erect any building designed or intended to be used for the purpose of storing shavings, sawdust or excelsior therein within the city without first obtaining the written consent of the property owners as required by the City ordinances.

926. **Frontage Consents — Business of Selling Provisions, Etc., in Residence Districts.)** It shall be unlawful for any person, firm or corporation to carry on the business of selling meats, poultry, fish, butter, cheese, lard, vegetables or any other provisions from any place of business located in any block in which all the other buildings are used exclusively for residence purposes, without first securing and filing with the City Collector the written consent of three-fourth of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located, provided in determining whether all the buildings in said block are used exclusively for residence purposes, any building fronting on another street and located upon a corner shall not be considered. In case a permit for building a store for such purposes in such block, or converting a building to store purposes in such block is applied for, the frontage consents required by this section shall be filed with the Commissioner of Buildings.

927. **Business of a Store—Requirements at to a Permit for Erection.)** No permit shall be issued for the erection or remodeling of any building in any block in which the use of buildings is restricted or regulated by ordinance if such building is designed to be used for conducting therein any business or store, without first requiring the applicant for such permit to file with the Commissioner of Buildings a plat showing the use to which all the property in such block is devoted.

928. **Withholding of Building Permit—Protest of Property Owners—Public Hearing.)** In all cases where an application for a permit is made for the erection of a new building in any square in which a majority

First Cavalry Armory, I. N. G.—Holabird & Roche, Architects

Vesta Battery Corp., Chicago — Puckey and Jenkins, Architects

of the buildings are used exclusively for residence purposes, or in a square on the opposite side of the street from such square so used for residential purposes; if there shall be filed with the Commissioner of Buildings a protest signed by not less than ten owners of property in such square so used for residential purposes, or in case the ownership of the frontage is in less than twenty persons then by a majority of the owners according to frontage, the Commissioner of Building shall withhold the issuance of the permit until the City Council shall have ordered a public hearing similar to that required in an act of the general assembly entitled "An Act to confer certain additional powers upon city councils in cities and presidents and boards of trustees in villages and incorporated towns concerning buildings and structures, the intensity of use of lot areas, the classification of trades, industries, buildings and structures with respect to location and regulations, the creation of districts of different classes, and the establishment of regulations and restrictions applicable thereto," in force June 28, 1921. For the purposes of this section a square shall be understood to be a plot of ground containing city lots surrounded by public streets, railway right of way, natural boundaries, or public places or thoroughfares.

929. **Garages — Frontage Consents Required.)** No person, firm or corporation shall keep, conduct or operate a garage in this city without first obtaining a license so to do in the manner provided for in this ordinance; and it shall not be lawful for any person, firm or corporation to locate, build, construct or maintain any garage within the territory bounded by the Chicago River and the south branch thereof on the north and west, by Lake Michigan on the east and by Van Buren Street on the south, any part of which is within eighty feet, or the entrance or exit to or from which, for the use of automobiles, is either within one hundred and sixty feet, of any portion of the street front of any building used as and for a hospital, church or public or parochial school, or such entrance or exit of which is upon a street containing street car tracks, and within one (1) block of the entrance of a street railway tunnel, or which shall house within said distance of one hundred and sixty feet of such street front, more than seventy-five cars. It shall not be lawful to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church or public or parochial school, or the ground thereof, in any portion of the City of Chicago outside of the territory above named, nor shall any person, firm or corporation locate, build, construct or maintain any garage in the city on any lot in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, or within one hundred feet of any such street in any such block, without the written consent of a majority of the property owners according to frontage on both sides of the street; provided that all lots which abut only on a public alley or court shall be considered as fronting on the street to which such alley or court leads. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building; provided, that in determining whether two-thirds of the buildings on both sides of such street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered and provided further that the word "block" as used in this section shall not be held to mean a square but shall be held to embrace only that part of the street in question which lies between the two nearest intersecting streets.

930. **Hospital or Home frontage consents.)** It shall be unlawful for any person, firm, association or corporation to build, construct, maintain, conduct or manage a hospital, or a home, as defined in chapter XXXIX of this ordinance, in any block in which two-thirds of the buildings fronting on both sides of the street or streets on or along which the proposed hospital or home may face are devoted exclusively to residence purposes, unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on or along which said building faces consent in writing to the building, construction or maintaining, managing or conducting of any such hospital or home in such block; provided, however, that no new frontage consents shall be required if such hospital or home has heretofore been licensed by the city of Chicago as a hospital, home or nursery at the present location. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or construction of any such hospital or home, and before a license shall be issued for the maintaining, conducting or managing of any such hospital or home.

931. **Undertaking establishment frontage consents.)** It shall be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in chapter XXXIX of this ordinance, that receives in connection with such business, at his, their or its place of business, the body of any dead person for embalming or other purposes, on or along any boulevard or pleasure driveway, without the written consent of a majority of the property owners according to the frontage on both sides of such boulevard or pleasure driveway in the block in which such morgue or place of business is located; it shall also be unlawful for any person, firm or corporation to establish or maintain a morgue or to carry on the business of an undertaker, as defined in chapter XXXIX of this ordinance, that receives, in connection with such business, at his, their or its place of business, the body of any dead person for embalming or other purposes, on or along any street in any block in which two-thirds of the buildins on both sides of the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided that nothing herein contained shall ap:ply to such location in the case of any person licensed as an undertaker and authorized to carry on such business at any such location at the time of the passage of this ordinance, nor to any block in any street on which street cars are operated. Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

932. **Ice Plant Frontage Consents.)** It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any ice-making house or cooling plant, or any buildings used for the storage of ice, in any block in which two-thirds of the buildings fronting on both sides of the street on which the proposed plant shall be located are devoted exclusively to residence purposes, unless the owners of the majority of the frontage in said block on both sides of the street on which said plant is located shall consent in writing to the location, establishment, conducting or maintenance of such plant in such block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Buildings before a permit shall be granted for the building or construction of any such ice-making house or cooling plant. Any person, firm or corporation violating any of

the provisions of the section, or refusing, failing or neglecting to comply with any of the said provisions, shall be fined not less than five dollars nor more than one hundred dollars for each offense, and a separate offense shall be regarded as having been committed for each day during which such violation shall continue.

933. **Frontage consents—general requirements.)** Whenever frontage consents are required, for the construction of a building or for any occupation for which a building is about to be constructed or altered, under any section of this ordinance or under any other ordinance of the city, such frontage consents shall be presented to the commissioner of buildings before the issuance of a permit for the erection or alteration of a building for such purpose. Unless otherwise specified the provisions of this chapter in such case shall apply as to the definition of the word "block," whenever such word is used in provisions requiring frontage consents.

ARTICLE XXV.

Fire Limits.

934. **Fire limits—provisional fire limits.)** (a) The fire limits of the city of Chicago within which wooden buildings shall not be erected, shall be and they are hereby defined as follows: all that part of the city of Chicago bounded by the following limits: beginning at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and North Western Railway Company, then south along the east line of said right of way of the Chicago and North Western Railway Company to a line 125 feet north of the north line of Foster avenue, thence west along said line 125 feet north of the north line of Foster avenue to the center line of the North Shore channel, thence southeasterly along the center line of said North Shore channel to the center line of the North branch of the Chicago river, thence northwesterly and westerly along the center line of said North branch of the Chicago river to a line 125 feet west of the west line of north Kedzie avenue, thence south along said line 125 feet west of the west line of north Kedzie avenue, to a line 125 feet south of the south line of Irving Park boulevard, thence east along said line 125 feet south of the south line of Irving Park boulevard to the center line of the north branch of the Chicago river, thence northerly along the center line of the north branch of the Chicago river to the center line of Berteau avenue, thence east along the center line of Berteau avenue to a line 125 feet west of the west line of north Western avenue, thence south along said line 125 feet west of the west line of north Western avenue to the center line of Addison street, thence east along the center line of Addison street to the center line of north Western avenue, thence south along the center line of north Western avenue to the center line of Belmont avenue, thence east along the center line of Belmont avenue to the center line of Southport avenue, thence south along the center line of Southport avenue to the center line of Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of the North Branch of the Chicago river, thence northwesterly along the center line of the North Branch of the Chicago river to a line 125 feet north of the north line of Belmont avenue thence west along said line 125 feet north of the north line of Belmont avenue to a line 125 feet west of the west line of north Kostner avenue, thence south along said line 125 feet west of the west line of north Kostner avenue to a line 125 feet north of the north line of Diversey avenue, thence west along said line 125 feet north of the north line of Diversey avenue, to a line 125 feet west of the west line of north Cicero avenue, thence south along said line 125 feet west of the west line of north Cicero avenue to the center line of west Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of north Laramie avenue, thence south along the center line of north Laramie avenue to a line 125 feet northeasterly of the northeasterly line of west Grand avenue, thence northwesterly along said line 125 feet northeasterly of the northeasterly line of west Grand avenue to the center line of Harlem avenue, thence south along the center line of Harlem avenue to a line 125 feet southwesterly of the southwesterly line of west Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of west Grand avenue to a line 125 feet south of the south line of Armitage avenue; thence east along said line 125 feet south of the south line of Armitage avenue to a line 125 feet southwesterly of the southwesterly line of west Grand avenue, thence southeasterly along said line 125 feet southwesterly of the southwesterly line of west Grand avenue to the southerly line of the right of way of the Chicago, Milwaukee and St. Paul Railway Company, thence northwesterly and westerly along the southerly line of the said right of way of the Chicago, Milwaukee & St. Paul Railway Company to the center line of Narranganset avenue, thence south along the center line of Narragansett avenue to the center line of west North avenue, thence east along the center line of west North avenue to the center line of north Austin avenue, thence south along the center line of north Austin avenue to the center line of west Roosevelt road, thence east along the center line of west Roosevelt road to the center line of south Kenton avenue produced north, thence south along the center line of south Kenton avenue produced north and the center line of south Kenton avenue to the center line of west 39th street produced west, thence east along the center line of west 39th street produced west to the center line of the Illinois and Michigan canal, thence northeasterly along the center line of the Illinois and Michigan canal to the center line of south Western avenue boulevard, thence south along the center line of south Western avenue boulevard to the center line of west 39th street, thence east along the center line of west 39th street to the center line of south Robey street, thence south along the center line of south Robey street to the center line of west 43rd street, thence east along the center line of west 43rd street to a line 125 feet west of the west line of south Ashland avenue, thence north along said line 125 feet west of the west line of south Ashland avenue to the center line of west 41st street, thence east along the center line of west 41st street to the center line of south Ashland avenue, thence north along the center line of south Ashland avenue to the center line of west 40th street, thence east along the center line of west 40th street to a line 125 feet east of the east line of south Ashland avenue thence south along said line 125 feet east of the east line of south Ashland avenue to the center line of west 43rd street, thence west along the center line of west 43rd street to the center line of south Ashland avenue, thence south along the center line of south Ashland avenue to the center line of west 47th street, thence east along the center line of west 47th street to a line 125 feet west of the west line of south Halsted street, thence south along said line 125 feet west of the west line of south Halsted street to the center line of west 51st street, thence west along the center line of west 5st street to the center line of south Racine avenue, thence south along the center line of south Racine avenue to a line 125 feet north of the north line of west 63rd street, thence west along said line 125 feet north of the north line of west 63rd street

to the center line of south Western avenue, thence north along the center line of south Western avenue and south Western avenue boulevard to the center line of west 45th street, thence west along the center line of west 45th street and west 45th street produced west to the center line of south Cicero avenue, thence south along the center line of south Circero avenue to the center line of west 51st street, thence west along the center line of west 51st street to the southerly line of the right of way of the Chicago and Alton Railroad and thence southwesterly along said southerly line of the right of way of the Chicago and Alton Railroad to the center line of south Harlem avenue, thence south along the center line of south Harlem avenue to the center line of west 59th street, thence east along the center line of west 59th street to the center line of south Narragansett avenue, thence south along the center line of south Narragansett avenue and Narragansett avenue produced south to the center line of west 65th street produced west, thence east along the center line of west 65th street produced west and west 65th street to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 69th street produced west, thence east along the center line of west 69th street produced west and west 69th street to the center line of south Western avenue, thence north along the center line of south Western avenue to a line 125 feet south of the south line of west 63rd street, thence east along the said line 125 feet south of the south line of west 63rd street to the center line of south Racine avenue, thence south along the center line of south Racine avenue to the center line of west 75th street, thence west along the center line of west 75th street to a line 125 feet east of the east line of south Ashland avenue, thence north along said line 125 feet east of the east line of south Ashland avenue to the center line of west 71st street, thence west along the center line of west 71st street to a line 125 feet west of the west line of South Ashland avenue, thence south along said line 125 feet west of the west line of south Ashland avenue to the center line of west 75th street, thence west along the center line of west 75th street and west 75th street produced to the center line of south Cicero avenue, thence south along the center line of south Cicero avenue to the center line of west 87th street, thence east along the center line of west 87th street to the center line of south Western avenue, thence south along the center line of south Western avenue to the center line of west 99th street, thence west along the center line of west 99th street to the center line of south California avenue, thence south along the center line of south California avenue to the center line of west 115th street, thence east along the center line of west 115th street to the center line of south Western avenue, thence south along the center line of south Western avenue to the center line of west 119th street, thence east along the center line of west 119th street to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the center line of west 103rd street, thence east along the center line of west 103rd street to the center line of south Halsted street, thence north along the center line of south Halsted street to a line 125 feet south of the south line of west 95th street, thence east along said line 125 feet south of the south line of west 95th street to the center line of Eggleston avenue, thence north along the center line of Eggleston avenue and Eggleston avenue produced north to a line 125 feet south of the south line of west 83rd street, thence east along said line 125 feet south of the south line of west 83rd street to a line 125 feet east of the east line of Stewart avenue, thence south along said line 125 feet east of the east line of Stewart avenue and Stewart avenue produced south to a line 125 feet north of the north line of west 95th street, thence east along said line 125 feet north of the north line of west 95th street to a line 125 feet west of the west line of south State street, thence south along said line 125 feet west of the west line of south State street to a line 125 feet south of the south line of west 99th street, thence east along a line 125 feet south of the south line of west and east 99th street to a line 125 feet west of the west line of south Michigan avenue, thence south along said line 125 feet west of the west line of south Michigan avenue to a line 125 feet north of the north line of east 119th street, thence west along a line 125 feet north of the north line of east and west 119th street to a line 125 feet west of the west line of south Morgan street, thence south along said line 125 feet west of the west line of south Morgan street to a line 125 feet south of the south line of west 119th street, thence east along a line 125 feet south of the south line of west and east 119th street to a line 125 feet east of the east line of south Michigan avenue, thence north along said line 125 feet east of the east line of south Michigan avenue to a line 125 feet south of the south line of east 99th street, thence east along said line 125 feet south of the south line of east 99th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of east 115th street, thence east along the center line of east 115th street to the northeasterly line of the right of way of the Michigan Central Railroad Company, thence south and southeasterly along said northeasterly line of the right of way of the Michigan Central Railroad Company to the center line of east 127th street, thence east along the center line of east 127th street to the shore line of Lake Calumet, thence northwesterly and northeasterly along the shore line of said Lake Calumet to a line 125 feet east of the east line of Stony Island avenue, thence north along said line 125 feet east of the east line of Stony Island avenue to a line 125 feet north of the north line of east 95th street, thence west along said line 125 feet north of the north line of east 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the center line of east 83rd street, thence east along the center line of east 83rd street to the east line of the right of way of the New York, Chicago and St. Louis Railroad, thence south and southeast along said east line of the right of way of the New York, Chicago and St. Louis Railroad to the center line of east 87th street, thence east along the center line of east 87th street to the center line of Jeffery avenue, thence north along the center line of Jeffery avenue to the southwest line of the right of way of the Lake Shore and Michigan Southern Railway, thence southeast along said southwest line of the right of way of the Lake Shore and Michigan Southern Railway to a line 125 feet west of the west line of Yates avenue, thence north along said line 125 feet west of the west line of Yates avenue to a line 125 feet south of the south line of east 83rd street, thence east along said line 125 feet south of the south line of east 83rd street to the center line of Yates avenue, thence north along the center line of Yates avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the center line of Brandon avenue, thence south along the center line of Brandon avenue to the center line of east 83rd street, thence east along the center line of east 83rd street to

the center line of Burley avenue, thence south along the center line of Burley avenue, to the center line of east 89th street, thence west along the center line of east 89th street to a line 125 feet west of the west line of Manistee avenue, thence south along said line 125 feet west of the west line of Manistee avenue to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway, thence southeasterly along said northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway to the easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Ft. Wayne and Chicago Railroad Company, thence southwesterly along said easterly and southeasterly line of the South Chicago branch of the Pittsburgh, Ft. Wayne and Chicago Railroad Company to the center line of east 106th street, thence east along the south line of east 106th street to a line 200 feet east of the east bank of the Calumet river, thence northerly along said line 200 feet east of the east bank of the Calumet river to the center line of east 95th street, thence east along the center line of east 95th street to the shore of Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

(b) Also beginning at the intersection of the center line of Addison street and the center line of the North Branch of the Chicago river, thence west along the center line of Addison street to the center line of north Whipple street, thence south along the center line of north Whipple street to the center line of Elston avenue, thence southeasterly along the center line of Elston avenue to the center line of Roscoe street, thence east along the center line of Roscoe street to the center line of the North Branch of th Chicago River, thence north along the center line of the North Branch of the Chicago river to the place of the beginning.

(c) Excepting the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of Foster avenue and the center line of north Leavitt street, thence west along said line 125 feet south of the south line of Foster avenue to a line 125 feet east of the east line of north Western avenue, thence south along said line 125 feet east of the east line of north Western avenue to a line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue, thence southeasterly along said line 125 feet east of the east line of Lincoln avenue to a line 125 feet north of the north line of Lawrence avenue, thence east along said line 125 feet north of the north line of Lawrence avenue to the center line of north Leavitt street, thence north along the center line of north Leavitt street to the place of beginning.

(d) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of Belmont avenue and the center line of north Kedzie avenue, thence west along said line 125 feet south of the south line of Belmont avenue to the center line of north Crawford avenue, thence south along the center line of north Crawford avenue to the center line of north Fullerton avenue, thence east along the center line of Fullerton avenue to the center line of north Central Park avenue, thence north along the center line of north Central Park avenue to the center line of Diversey avenue, thence east along the center line of Diversey avenue to the center line of north Kedzie avenue, thence north along the center line of north Kedzie avenue to the place of beginning.

(e) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of te south line of west Division street and the center line of north Laramie avenue, thence west along said line 125 feet south of the south line of west Division street to the center line of north Central avenue, thence south along the center line of north Central avenue to the center line of west Chicago avenue, thence east along the center line of west Chicago avenue to the center line of north Laramie avenue, thence north along the center line of north Laramie avenue to the place of beginning.

(f) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 43rd street and a line 125 feet west of south State street, thence west along the center line of west 43rd street to a line 125 feet east of the east line of Wentworth avenue, thence south along said line 125 feet east of the east line of Wentworth avenue to the center line of west Garfield boulevard, thence east along the center line of west Garfield boulevard to a line 125 feet west of the west line of south State street, thence north along said line 125 feet west of the west line of south State street to the place of beginning.

(g) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 40th street and the center line of Normal avenue, thence west along the center line of west 40th street to the center line of Wallace street, thence south along the center line of Wallace street to the center line of west 43rd street, thence west along the center line of west 43rd street to a line 125 feet east of the east line of south Halsted street, thence south along said line 125 feet east of the east line of south Halsted street to the center line of west 51st street, thence east along the center line of west 51st street to the center line of south Union avenue, thence south along the center line of south Union avenue to the center line of west Garfield boulevard, thence east along the center line of west Garfield boulevard to a line 125 feet west of the west line of Wentworth avenue, thence north along said line 125 feet west of the west line of Wentworth avenue to the center line of west 43rd street, thence west along the center line of west 43rd street to the center line of Normal avenue, thence north along the center line of Normal avenue to the place of beginning.

(h) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 52nd street and the center line of south Peoria street, thence west along the center line of west 52nd street to the center line of south Morgan street, thence south along the center line of south Morgan street to the center line of west 53rd street, thence east along the center line of west 53rd street to the center line of south Peoria street, thence north along the center line of south Peoria street to the place of beginning.

(i) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west 83rd street and the center line of south Winchester avenue, thence west along said line 125 feet south of the south line of west 83rd street to the east line of the right of way of the Pittsburgh, Chicago, Cincinnati and St. Louis Railway, thence southeasterly along the said east line of the right of way to the Pittsburgh, Chicago, Cincinnati and St. Louis Railway to the center line of west 87th street, thence east along the center line of west 87th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the northwestern boundary line of the right of way of the Chicago, Rock Island and Pacific Railway Company in south Hermitage avenue, thence northeasterly in south Hermitage avenue along said northwestern boundary line of the right of way of the Chicago, Rock Island and Pacific Railway Company

to the center line of south Winchester avenue, thence northwesterly and north along the center line of south Winchester avenue to the place of beginning.

(j) Excepting also the district bounded as follows: beginning at the intersection of the center line of west 91st street and a line 125 feet west of the west line of south Ashland avenue, thence west along the center line of west 91st street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to a line 125 feet west of the west line of south Ashland avenue, thence north along said line 125 feet west of the west line of south Ashland avenue to the place of beginning.

(k) Excepting also the district bounded as follows: beginning at the intersection of a line 125 feet south of the south line of west 95th street and the center line of Vincennes avenue, thence west along said line 125 feet south of the south line of west 95th street to the center line of Beverly avenue, thence southeasterly along the center line of Beverly avenue to the center line of Vincennes avenue, thence northeasterly along the center line of Vincennes avenue to the place of beginning.

(l) Excepting also the following territory, which shall be known as a provisional fire limit district: beginning at the intersection of the shore of Lake Michigan and the center line of Rogers avenue, thence southwesterly along the center line of Rogers avenue to the east line of the right of way of the Chicago and North Western Railway Company, thence south along the east line of the right of way of the Chicago and North Western Railway Company to the center line of Devon avenue, thence east along the center line of Devon avenue to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(m) Excepting also the following territory which shall be known as a provisional fire limit district: beginning at the intersection of the shore of Lake Michigan and the center line of east 67th street, thence west along the center line of east 67th street to the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue, thence north along the center line of Cottage Grove avenue to the center line of east 63rd street , thence west along the center line of East 63rd street to the center line of South Park avenue, thence south along the center line of South Park avenue to the center line of east Marquette road, thence west along the center line of east Marquette road to the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway Company, thence northwesterly along the northeasterly line of the right of way of the Lake Shore and Michigan Southern Railway Company to the center line of south State street, thence south along the center line of south State street to the center line of east 75th street, thence east along the center line of east 75th street to the center line of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the east line of the right of way of the Illinois Central Railroad, thence north along the east line of the right of way of the Illinois Central Railroad to the center line of east 79th street, thence east along the center line of east 79th street to the center line of Stony Island avenue, thence south along the center line of Stony Island avenue to a line 125 feet south of the south line of east 79th street, thence east along said line 125 feet south of the south line of east 79th street to the shore of Lake Michigan, thence northwesterly along the shore of Lake Michigan to the place of beginning.

(n) Excepting also the following territory which shall be known as a provisional fire limit district; beginning at the intersection of the center line of east 87th street and a line 125 feet east of the east line of the right of way of the Illinois Central Railroad, thence west along the center line of east 87th street to a line 125 feet west of the west line of South Park avenue, thence south along said line 125 feet west of the west line of South Park avenue to the center line of east 95th street, thence east along the center line of east 95th street to a line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company, thence northeasterly along said line 125 feet east of the east line of the right of way of the Illinois Central Railroad Company to the place of beginning.

(o) Within the provisional fire limits above described it shall be unlawful to erect a frame or wooden building to be used for residence or mercantile purposes upon presenting a petition to the commissioner of buildings, together with a plat, plans and specifications showing the space where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon both sides of the streets surrounding the square in which the proposed building is to be erected.

(p) No frame or wooden residence or mercantile building shall be erected within the provisional fire limits exceeding 40 feet in height.

935. **Maps showing fire limits.)** As soon as practicable after the passage of this ordinance the superintendent of maps shall prepare, or cause to be prepared, three maps of the city of Chicago drawn to a scale sufficiently large to meet the requirements of this section, on which shall be accurately indicated the area and boundaries of the fire limits and of the provisional fire limits, as defined in the preceding section. Such maps shall be alike in all respects. One of said maps, when found to be accurate and in strict compliance with the foregoing section with respect to areas and boundaries, to the satisfaction of the mayor, shall be marked as approved by the mayor, and shall be placed in the custody of the city clerk, and the same shall be kept on file in the office of said clerk and regarded as an exhibit the same as if were a part of this ordinance. Another of said maps shall be turned over to the commissioner of buildings, whose duty it shall be to preserve the same, and to supervise the correction of all three of said maps from time to time as hereinafter provided. The third of said maps shall be retained by the superintendent of maps. Such maps may be altered, corrected, revised or replaced from time to time as the city council may direct.

After the passage of this ordinance the city council, in future ordinances making changes in the fire limits or provisional fire limits of the city, may make reference to the said map on file in the city clerk's office, and may alter, correct or revise the fire limits or the provisional fire limits of the city by reference thereto or by stating what change shall be made to the fire limits or provisional fire limits as shown on said map; such references to said map, when clear and unambiguous, shall be deemed authoritative and shall be regarded as describing the areas and boundaries of the changed portion of the said fire limits or provisional fire limits regardless of whether the language of such ordinance correctly amends the preceding section or not; and such alterations, corrections and revisions, when duly passed, approved and published, shall be deemed amendments of the preceding section and shall be construed as altering, correcting

and revising the fire limits as set forth in the preceding section.

It shall be the duty of the superintendent of maps to correct the said maps under the supervision of the commissioner of buildings so as to accurately portray the fire limits and provisional fire limits up to date whenever a change is authorized therein as by this section provided, and to replace the said maps with new maps when the city council so directs.

ARTICLE XXVI.

Regulations Concerning Places of Amusement.

936. **No amusement license to issue without certificate from city officials.)** No license shall be issued to any person, firm or corporation to produce, present, conduct, operate or offer for gain or profit, any theatricals, shows or amusements until the commissioner of buildings, the commissioner of health, the chief of fire prevention and public safety and the commissioner of gas and electricity shall have certified in writing that the room or place where it is proposed to produce, present, conduct, operate or offer such theatricals, shows or amusements complies in every respect with the ordinances of the city of Chicago relating to their respective departments.

937. **Lighting—building kept lighted during performance.)** Every portion of any building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain or profit, devoted to the use or accomodation of the public, and all outlets therefrom leading to the street, including all open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and shall remain lighted until the entire audience has left the premises. It shall be the duty of the chief of fire prevention and public safety to enforce the provisions of this section.

938. **Independent lighting system for exits.)** All stairways and corridors in every building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain shall be supplied with a supplemental lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building or structure and shall be in operation during the entire period that such building or structure is open to the public and until the entire audience has left the building.

The word "EXIT" shall appear in letters at least six inches high over the opening of every means of egress from such building or structure, and a red light shall be kept burning over such sign.

It shall be the duty of the commissioner of gas and electricity to enforce the provisions of this section relative to the installation of the lighting provisions contained therein; and it shall be the duty of the chief of fire prevention and public safety to see that the lights are kept lighted as required by this section.

939. **Gas calcium lights prohibited—arc lights.)** The use of gas calcium lights in any building in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain is hereby prohibited.

All arc lights used on the stage shall be subject to the approval of the commissioner of gas and electricity.

940. **Exit doors or gates not to be locked—obstructions prohibited.)** No exit door or gate in any place in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain shall be locked or fastened in any manner during the entire time that such place of amusement is open to the public.

All aisles, passageways, corridors and exits of all such places of amusement shall be kept free from camp stools, chairs, sofas, draperies and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance.

941. **Diagram of exits and seats.)** It shall be the duty of the owner, lessee or manager of any theater having a seating capacity in excess of three hundred persons to cause to be printed on all programs furnished for any performance, on the page opposite to that upon which the cast is printed, a diagram showing conspicuously the place of every exit from such building. A diagram of the floor plan, showing the location of every seat on each floor, and also the exits leading from each floor, drawn to a scale of one-eighth of an inch to the foot, shall be posted in a conspicuous place at or near the box office of any such theater, so as to be easily seen by the public. It shall be the duty of the chief of fire prevention and public safety to enforce the provisions of this section.

942. **Penalty.)** Any person, firm or corporation violating any of the provisions of this article shall be fined not more than two hundred dollars for each offense, and each and every day upon which any such person, firm or corporation shall give, conduct, produce, present, offer or operate any such entertainment contrary to or in violation of any of the provisions of this article shall constitute a separate and distinct offense.

ARTICLE XXVII.

NUISANCE AND PENALTY.

943. **Nuisance.)** (a) Every building or structure constructed or maintained in violation of this chapter, or which is in an unsanitary condition, or in an unsafe or dangerous condition or which in any manner endangers the health or safety of any person or persons, is hereby declared to be a public nuisance.

(b) Every building or part thereof which is in an unsanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water, or by reason of the presence of sewer gas, or by reason of any portion of a building being infected with disease or being unfit for human habitation, or which, by reason of any other unsanitary condition, is a source of sickness, or which endangers the public health, is hereby declared to be a public nuisance.

944. **Theatres Located Above the First Floor Declared a Nuisance — Exceptions — Regulations.)** It shall be and it is hereby declared to be a nuisance to conduct a public theatre in a room located on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built. All such public theatres now being conducted in rooms on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of

Chicago with reference to fireproof construction in force at the time such building was built, with a seating capacity of more than three hundred, shall be and they are hereby declared to be nuisances; and it shall be unlawful to continue to use such rooms for public theatrical purposes whether the same are equipped with a stage and scenery or are used for moving picture shows only.

The provisions of the foregoing paragraph shall not apply where the theatre is altered so as to bring the main audience room on the first floor level and slow-burning construction is used in the reconstruction work and in making such alterations and all requirements of the ordinances of the City applying to Class IVb are complied with, nor shall said provisions apply where the following conditions are fully complied with:

(a) The building shall be used for theatre purposes only.

(b) The seating capacity shall not exceed the seating capacity existing therein on July 22 1912.

(c) Metal scenery only shall be used; provided, however, one proscenium drop, one back drop and three borders may be used provided they are of asbestos cloth subject to the approval of the Chief of Fire Prevention and Public Safety.

(d) All seats shall be at least eighteen inches wide and spaced thirty-two inches from back to back.

(e) There shall be no boxes, stalls or loges.

(f) No stove or furnace heating shall be allowed.

(g) All lighting shall be by electricity; provided, however, that gas may be used in connection with exit lights.

(h) At least sixty inches of exit space shall be provided for every one hundred seats.

(i) The stage shall not be more than twenty-two feet from front to rear.

(j) The audience room shall be surrounded by brick walls.

(k) In all cases where dressing rooms are placed back of the stage the brick wall shall extend between the stage and such dressing rooms, but the stage wall may contain a door leading to such dressing room located behind said wall.

(l) All dressing rooms shall have incombustible partitions, and all existing wooden partitions, wherever located, shall be removed.

(m) There shall be an open space on at least three sides of the building containing such theatre, except as otherwise herein provided, which space shall be open from the floor level of the auditorium to the sky.

(n) One of such open spaces must be a public street and the others public or private alleys or open spaces leading directly to a street or public or private alley, and in all cases where such open space is private ground, it must be at least five feet wide where the seating capacity does not exceed six hundred, and six inches additional width must be provided for each one hundred seats installed in such theatre in excess of six hundred; provided, however, that in all cases where a sprinkler system is installed over the stage, together with an approved power pump and pressure tank subject to the approval of the Chief of Fire Prevention and Public Safety, it shall be sufficient if there are open spaces as above required on two sides of the building in which such theatre is located.

(o) Wherever the side of an audience room adjoins an open space, as hereinabove required, which open space is on private ground or is a private or public alley, there shall be a five-foot open iron platform extending the entire length of the audience room, with an open iron stairway leading to the ground from said platform at each end thereof, and in all such cases there shall be a stairway fire escape leading from the gallery of the theatre, if there is a gallery, to such platform.

(p) Where the only open space adjoining the side of the audience room is a public street, there shall be a five-foot stairway, enclosed by walls of incombustible material, leading from the middle of the audience room on the side contiguous to such street to the first floor, at the bottom of which stairway there shall be an exit opening directly to the street, and in such cases there shall be a three-foot stairway leading from the gallery, if there is a gallery, to the main floor of the auditorium, the bottom of which shall be within ten feet of the stairway leading from such main floor to the ground floor.

(q) There shall be an exit at least five feet wide on each side of the stage, which exit shall lead through a passageway constructed entirely of incombustible material to a stairway which shall be completely enclosed with incombustible material. Said stairway shall lead to the ground level and communicate through a passageway of incombustible material directly with a public street or alley or a private alley which leads directly to a public street or alley.

(r) An exit shall be provided on each side of the balcony or gallery at the end nearest the stage by means of a stairway of incombustible material leading to the main floor of the audience room.

(s) The exits at the front of the theatre shall communicate with stairways of incombustible material leading directly to the ground level and either opening directly out upon the street or communicating with the street through fireproof passageways, and in no case shall any stairway leading from the main audience floor to the ground level communicate or connect with any other such stairway.

(t) All doors leading through the proscenium wall or from the stage to the dressing rooms shall be of incombustible material.

(u) All alterations made in buildings containing such theatres shall be of slow-burning construction, except as herein otherwise provided.

945. **Penalty.)** Any person, firm or corporation that violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, where no other penalty is provided, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense and every such person, firm or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue; and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designing, drawing plans for, or having charge of such building, or who who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

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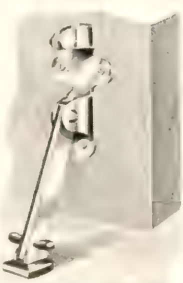

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Special Rulings of the Building Department of the City of Chicago

These rulings are not a part of the Code of the City of Chicago; but are requirements of the Building Department.

BRACING OF TRUSSES, COLUMNS, WALLS, ETC., IN STEEL SKELETON CONSTRUCTION.

I

In regard to Section 555 of the Revised Building Ordinances, the Commissioner has ruled that the following interpretation shall be placed upon the section concerning bracing:

(a) All skeleton buildings, trusses, and structures shall be securely braced during erection by guys, cables or such other temporary supports as may be necessary to provide for stresses due to erection.

(b) Special wind bracing shall be provided in steel skeleton buildings over one hundred (100) feet in height or higher than twice the least width.

(c) For permanent construction bracing shall be so designed that the **skeleton will be self-supporting and safe against lateral and buckling or crippling forces before any of the inclosing walls or roofs are built in place.**

(d) In cases where wind forces are nominal and to prevent buckling or crippling, the minimum amount of bracing required shall be ¾" rod for steel tension members or equivalent in other material. Compression members shall be limited in length to one hundred and fifty (150) times the least radius of gyration or otherwise as specified in the Ordinances.

(e) Trusses shall be properly anchored to the walls at the point of bearing in such a way as not to strain the masonry on account of the temperature stresses in the truss.

(f) In general, all eccentric loading on the foundations shall be avoided and where not possible to do so, proper bracing between opposite walls shall be provided, sufficient to offset the bending moment due to eccentricity.

NOTES ON REINFORCED CONCRETE DESIGN.

II

(a) In regard to Section 763, as applying to a combination of tile and concrete construction, the Commissioner has ruled that the width of flange of the concrete joists may be assumed as the full distance c. to c. of ribs but not exceeding eight (8) times the thickness of the concrete on top of tile fillers, plus the average width of rib.

(b) In computing the shear at supports, the average width of the concrete rib plus the thickness of the tile on one side of the rib may be figured as the effective width of joist, provided that joints in tile are properly staggered.

(c) When steel or plaster fillers are used between concrete joists, the width of flange shall be limited to three-fourths (¾) of the distance center to center of ribs as per Section 763.

In regard to Section 760 (e)

(a) When compression is applied to a surface of concrete of at least twice the loaded area, a stress of thirty (30) per cent of the ultimate may be allowed, and

(b) In continuous beams and girders the compressive stress in extreme fibre at the support may be fifteen (15) per cent greater than at the center of span.

In regard to Section 762 (1)

The total amount of steel required for square slabs with two-way reinforcement may be reduced twenty (20) per cent by gradually increasing the rod spacing from the third point to the edge of the slab.

THE DESIGN OF FLAT SLABS SHALL BE IN ACCORDANCE WITH THE FOLLOWING RULING.

III

Definitions.

(1) Flat slabs as understood by this ruling are reinforced concrete slabs, supported directly on reinforced concrete columns with or without plates or capitals at the top, the whole construction being hingeless and monolithic without any visible beams or girders. The construction may be such as to admit the use of hollow panels in the ceiling or smooth ceiling with depressed panels in the floor.

(2) The column capital shall be defined as the gradual flaring out of the top of the column without any marked offset.

(3) The drop panel shall be defined as a square or rectangular depression around the column capital extending below the slab adjacent to it.

(4) The panel length shall be defined as the distance center to center of columns of the side of a square panel, or the average distance center to center of columns of the long and short sides of a rectangular panel.

Columns.

(5) The least dimension of any concrete column shall be not less than one-twelfth (1/12) the panel length, nor one-twelfth (1/12) the clear height of the column.

Slab Thickness.

(6) The minimum total thickness of the slab in inches shall be determined by the formula: $t = \frac{W^{1/2}}{44}$ = square root of W divided by forty-four, where t = total thickness of slab in inches, W = total live and dead load in pounds on the panel, measured center to center of columns.

(7) In no case shall the thickness be less than one thirty-second of the panel length (L/32) for floors, nor one-fortieth of the panel length (L/40) for roofs, (L being the distance center to center of columns).

(8) In no case shall the thickness of slab be less than six inches (6") for floors or roofs.

Column Capital.

(9) When used the diameter of the column capital shall be measured where its vertical thickness is at least one and one-

half inches ($1\frac{1}{2}''$), and shall be at least two hundred and twenty-five thousandths (.225) of the panel length.

The slope of the column capital shall nowhere make an angle with the vertical of more than forty-five degrees. Special attention shall be given to the design of the column capital in considering eccentric loads, and the effect of wind upon the structure.

Drop Panel.

(10) When used, the drop panel shall be square or circular for square panels and rectangular or elliptical for oblong panels.

(11) The length of the drop shall not be less than one-third of the panel length (L/3) if square, and not less than one-third of the long or short side of the panel respectively, if rectangular.

(12) The depth of the drop panel shall be determined by computing it as a beam, using the negative moment over the column capital specified elsewhere in this ruling.

(13) In no case, however, shall the dimensions of the drop panel be less than required for punching shear along its perimeter, using the allowable unit shearing stresses specified below.

Shearing Stresses.

(14) The allowable unit punching shear on the perimeter of the column capital shall be three-fiftieths (3/50) of the ultimate compressive strength of the concrete as given in section 759 of the building ordinance. The allowable unit shear on the perimeter of the drop panel shall be three one-hundredths (3/100) of the ultimate compressive strength of the concrete. In computing shearing stress for the purpose of determining the resistance to diagonal tension the method specified by the ordinance shall be used.

Panel Strips.

(15) For the purpose of establishing the bending moments and the resisting moments of a square panel, the panel shall be divided into strips known as strip A and strip B. Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter ($\frac{1}{4}$) of the panel length. Strip B shall include the reinforcement and slab in the half width remaining in the center of the panel. At right angles to these strips, the panel shall be divided into similar strips A and B, having the same widths and relations to the center line of the columns as the above strips. These strips shall be for designing purposes only, and are not intended as the boundary lines of any bands of steel used.

(16) These strips shall apply to the system of reinforcement in which the reinforcing bars are placed parallel and at right angles to the center line of the columns, hereinafter known as the two-way system, and also to the system of reinforcement in which the reinforcing bars are placed parallel, at right angles to and diagonal to the center line of the columns hereinafter known as the four-way system.

(17) Any other system of reinforement in which the reinforcing bars are placed in circular, concentric rings and radial bars, or systems with steel rods arranged in any manner, whatsoever, shall comply with the requirements of either the two-way or the four-way system herein specified.

Bending Moment Coefficients, Interior Panel, Two-way System.

(18) In panels where standard drops and column capitals are used as above specified, the negative bending moment taken at a cross-section of each strip A at the edge of the column capital or over it, shall be taken as $\frac{WL}{30}$

(19) The positive bending moment taken at a cross-section of each strip A midway between column centers, shall be taken as $\frac{WL}{60}$

(20) The positive bending moment taken at a cross-section of each strip B in the middle of the panel shall be taken as $\frac{WL}{120}$

(21) The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken as $\frac{WL}{120}$

(22) In the fomulas hereinabove given

"W" = total live and dead load on the whole panel in pounds,

"L" = panel length, center to center of columns.

Bending Moment Coefficients, Interior Panel, Four-way System.

(23) In panels where standard drops and column capitals are used as above specified, the negative bending moment taken at a cross-section of each strip A at the edge of column capital or over it, shall be taken as $\frac{WL}{30}$

(24) The positive bending moment taken at a cross-section of each strip A, midway between column centers shall be taken as $\frac{WL}{80}$

(25) The positive bending moment taken at a cross-section of each strip, B, taken in the middle of the panel shall be taken as $\frac{WL}{120}$

(26) The negative bending moment taken at a cross-section of each strip B on the center line of the columns shall be taken as $\frac{WL}{120}$

Bending Moment Coefficients, Wall Panels.

(27) Where wall panels with standard drops and capitals are carried by columns and girders built in walls, as in skeleton construction, the same coefficients shall be used as for an interior panel, except as follows: The positive bending moments on strips A and B midway between wall and first line of columns shall be increased twenty-five (25%) per cent.

(28) Where wall panels are carried on new brick walls, these shall be laid in Port-

land cement mortar and shall be stiffened with pilasters as follows: If a sixteen-inch wall is used, it shall have a four-inch pilaster. If a twelve-inch wall is used, it shall have an eight-inch pilaster. The length of pilasters shall be not less than the diameter of the column, nor less than one-eighth (⅛) of the distance between pilasters. The pilasters shall be located opposite the columns as nearly as practicable, and shall be corbeled out four inches at the top, starting at the level of the base of the column capital. Not less than eight (8″) inches bearing shall be provided for the slab, the full length of wall.

The coefficients of bending moments required for these panels shall be the same as those for the interior panels except as provided herewith: The positive bending moments on strips A and B midway between the wall and first line of columns shall be increased fifty (50%) per cent.

(29) Where wall panels are supported on old brick walls, there shall be columns with standard drops and capitals built against the wall which shall be tied to the same in an approved manner, and at least an eight-inch bearing provided for the slab, the full length. Where this is impracticable, there shall be built a beam on the underside of slab adjacent to the wall between columns, strong enough to carry twenty-five (25%) per cent. of the panel load.

The coefficients of bending moments for the two cases of slab support herein described shall be the same as those specified in Sec. 27 and Sec. 28 for skeleton and wall bearing condition respectively.

(30) Nothing specified above shall be construed as applying to a case of slabs merely resting on walls or ledges, without any condition of restraint. These shall be figured as in ordinary beam and girder construction specified in the Ordinances.

Bending Moment Coefficients, Wall and Interior Columns.

(31) Wall columns in skeleton construction shall be designed to resist a bending moment of $\frac{WL}{60}$ at floors and $\frac{WL}{30}$ at roof. The amount of steel required for this moment shall be independent of that required to carry the direct load. It shall be placed as near the surface of the column as practicable on the tension sides, and the rods shall be continuous in crossing from one side to another. The length of rods below the base of the capital and above the floor line shall be sufficient to develop their strength through bond, but not less than forty (40) diameters, nor less than one-third (1/3) the clear height between the floor line and the base of the column capital.

(32) The interior columns must be analyzed for the worst condition of unbalanced loading. It is the intention of this ruling to cover ordinary cases of eccentric loads on the columns by the requirement of Sec. 5. Where the minimum size of column therein specified is found insufficient, however, the effect of the resulting bending moment shall be properly divided between the adjoining slab and the columns above and below according to best principles of mechanics and the columns enlarged sufficiently to carry the load safely.

Bending Moment Coefficients, Panels Without Drops, or Capitals, or Both.

(33) In square panels where no column capital or no depressions are used, the sum total of positive and negative bending moments shall be equal to that computed by the following formula:

$$B.M. = \frac{WL}{8} (1.53 - 4k + 4.18\,k^3)$$

where B.M. = numerical sum of positive and negative bending moments, regardless of algebraic signs.

W = total live and dead load on the whole panel.

L = length of side of a square panel, c. to c. of columns.

K = ratio of the radius of the column or column capital to panel length, L.

This total bending moment shall be divided between the positive and the negative moments in the same proportion as in the typical square panels for two-way or four-way systems specified above for interior and wall panels respectively.

Points of Inflection.

(34) For the purpose of making the calculations of the bending moment at the sections away from the column capitals, the point of inflection shall be considered as being one-quarter (¼) the distance center to center of columns, both cross-wise and diagonally, from the center of the column.

Tensile Stress in Steel and Compressive Stress in Concrete.

(35) The tensile stress in steel and the compressive stress in the concrete to resist the bending moment shall be calculated on the basis of the reinforcement and slab in the width included in a given strip, and according to the assumption and requirements given in sections 758 to 761 inclusive of the building ordinance.

The steel shall be considered as being concentrated at the center of gravity of all the bands of steel in a given strip.

(36) For the four-way system of reinforcement the amount of steel to resist the negative bending moment over the support in each strip A shall be taken as the sum of the areas of steel in one cross band and one diagonal band. The amount of steel to resist the positive bending moment of each strip B shall be considered as the area of the steel in a diagonal band. The amount of steel to resist the positive bending moment in each strip A shall be considered as the area of the steel in a cross-band, and the amount of steel to resist the negative moment in each strip B shall be the steel included in the width of strip B.

(37) For the two-way system of reinforcement the amount of steel to resist the bending moment in any strip shall be considered as the area of steel included in the width of the strip.

(38) In both systems of reinforcement the compressive stress in the concrete in any strip shall be calculated by taking the area of steel considered for each strip, and applying it in a beam formula based on the principles of section 761 of the building ordinance.

(39) Where drop panels are used, the width of beam assumed to resist the compressive stresses over the column capital shall be the width of the drop.

(40) The width of beam where no drop panels are used, shall be the width of steel bands. Where this is found insufficient, the area shall be increased by introducing compression steel in the bottom of slab.

Rectangular Panels.

(41) When the length of panel in either two-way or four-way system does not exceed the breadth by more than five (5%) per cent, all computations shall be based on a square panel whose side equals the mean of the length and breadth, and the steel equally distributed among the strips according to the coefficients above specified.

(42) In no rectangular panel shall the length exceed the breadth by more than one-third (1/3) of the latter.

Rectangular Panels, Four-Way System.

(43) In the four-way system of reinforcement where length exceeds breadth by more than five (5%) per cent, the amount of steel required in strip A, long direction, both positive and negative, shall be the same as that required for the same strip in a square whose length is equal to the long side of the rectangular panel.

(44) The amount of steel, strip A, short direction, positive and negative, shall be the same as that required for the same strip in a square panel, whose length is equal to the short side of the rectangular panel.

(45) The amount of steel in strip B, positive and negative, shall be the same as that required for similar strip in a square panel whose length is equal to the mean of the long and the short side of the rectangular panel.

(46) In no case shall the amount of steel in the short side be less than two-thirds (2/3) of that required for the long side.

Rectangular Panels, Two-way System.

(47) In the two-way system of reinforcement the amount of steel required for the positive and the negative moment of each strip A shall be determined in the same manner as indicated for the four-way system above.

(48) The amount of steel in strip B, positive and negative, running in short direction, shall be equal to that required for the same strip in a square panel whose length equals the long side of the rectangular panel.

(49) The amount of steel in strip B, long direction, positive and negative, shall be equal to that required for the same strip in a square panel, whose length equals the short side of the rectangular panel.

(50) In no case shall the amount of steel in strip B, long direction, be less than two-thirds (2/3) of that in the short direction.

Walls and Openings.

(51) Girders and beams shall be constructed under walls, around openings and to carry concentrated loads.

Spandrel Beams.

(52) The spandrel beams or girders shall, in addition to their own weight and the weight of the spandrel wall, be assumed to carry twenty (20%) per cent of the wall panel load uniformly distributed upon them.

Placing of Steel.

(53) In order that the slab bars shall be maintained in the position shown in the design during the work of pouring the slab, spacers and supports shall be provided satisfactory to the Commissioner of Buildings. All bars shall be secured in place at intersections by wire or other metal fastenings. In no case shall the spacing of the bars exceed nine inches (9"). The steel to resist the negative moment in each strip B shall extend one-quarter (¼) of the panel length beyond the center line of the columns in both directions.

(54) Splices in bars may be made wherever convenient, but preferably at points of minimum stress. The length of splice beyond the center point, in each direction, shall not be less than forty diameters (40d) of the bars, nor less than two feet (2'0"). The splicing of adjacent bars shall be avoided as far as possible.

(55) Slab bars which are lapped over the column, the sectional area of both being included in the calculations for negative moment, shall extend not less than twenty-five one-hundredths (.25) of the panel length for cross-bands, and thirty-five one-hundredths (.35) of the panel length for diagonal bands, beyond the column center.

Computations.

(56) Complete computations of interior and wall panels and such other portions of the building as may be required by the Commissioner of Buildings shall be left in the office of the Commissioner of Buildings when plans are presented for approval.

Test of Workmanship.

(57) The Commissioner of Buildings or his representative may choose any two adjacent panels in the building for the purpose of ascertaning the character of workmanship. The test shall not be made sooner than the time required for the cement to set thoroughly, nor less than six weeks after the concrete has been poured.

(58) All deflections under test load shall be taken at the center of the slab, and shall be measured from the normal unloaded position of the slab. The two panels selected shall be uniformly loaded over their entire area with a load equal to the dead load plus twice the live load, thus obtaining twice the total design load. The load shall remain in place not less than twenty-four (24) hours. If the total deflection in the center of the panel under the test load does not exceed one eight-hundredth (1/800) of the panel length, the slab may be placarded to carry the full design live load. If it exceeds this amount of deflection, and recovers not less than eighty per cent (80%) of the total deflection within seven days after the load is removed, the slab may be placarded to carry the full design live load. If the deflection exceeds the allowable amount above specified, and the recovery is less than eighty per cent (80%) in seven days after the removal of the test load, other tests shall be made on the same or other panels, the results of which will determine the amount of live load the slabs will be permitted to carry.

General.

(59) The design and the execution of the work shall conform to the general provisions and the spirit of the Chicago Building Ordinances in points not covered by this Ruling, and to the best engineering practice in general.

Enforcement.

(60) This ruling shall be in effect on and after March first, Nineteen Hundred and Eighteen (March 1st, 1918), and shall supersede all previous rulings on flat slabs.

Signed: CHAS. BOSTROM,
Commissioner of Buildings.

FIREPROOFING OF REINFORCED CONCRETE COLUMNS.

IV

In reference to Section 762-j and Section 776 of the Chicago Building Ordinance, the Commissioner has ruled that in buildings classed as ordinary construction the full section of the column may be calculated in columns reinforced with vertical rods only. In buildings classed as slow burning or mill construction, the outside one and one-half inches shall not be figured in columns reinforced with vertical rods only, and in buildings classed as fireproof construction the outside two inches shall not be figured in the strength of columns with vertical rods only. When spiral reinforcement is used, only the area within the core shall be figured in accordance with Section 764-b.

CAISSONS.

V

Ruling.—The Commissioner has ruled that in determining the area required for concrete caissons, the load on the caissons shall be the load for which the basement column was designed, and the allowable stress on the concrete shall be as given in Section 746 (a). The allowable stress used shall be the stress at the top of the caisson.

A RULING ON COUNTERBALANCE OF STAIRWAY FIRE ESCAPES.

VI

The Commissioner of Buildings has made a ruling in regard to the construction of the movable part of stairway fire escapes as follows:

All counterbalance stairway fire escapes hereafter constructed shall conform to the following requirements in addition to those specified in the Building Ordinance for fixed stairway fire escapes, Section 882.

(a) The stringer carrying the counterweight may be built of steel channels, angles or "I" beams or any combination thereof, not less than eight inches deep and ⅜" metal, but it shall be so designed that the maximum fibre stress over the support shall not exceed 8,000 pounds per square inch and the moment of inertia about the vertical axis parallel to the web of the stringer shall not be less than 33% of the moment of inertia about the horizontal axis perpendicular to the web and passing through the center, which shall be accomplished by riveting an angle or angles onto the channel or "I" beam stringer.

(b) The same section of stringer shall be continued for equal distances on either side of the support and the reinforcement shall be extended as close to the counterweight as practicable.

(c) The truss rod from the counterweight to the opposite end of the stringer shall always be used either as an independent brace or in connection with the railing to prevent any sag of the stringer and shall be at least ¾" in diameter firmly connected, the strength of connection to be sufficient to develop the strength of the rod, but in figuring stresses, the stringer must be assumed to carry the total dead and live load as required by the ordinance.

(d) The connection between the stringer and the supporting rod must be designed to stiffen the stringer securely against horizontal or twisting motion by means of a steel casting or forging riveted to the stringer both through the web and the flange.

ILLUMINATED AND OTHER ROOF SIGNS OF STEEL SKELETON CONSTRUCTION.

VII

In regard to Section 919, of revised Building Ordinances, the Commissioner has ruled that all illuminated roof signs of steel construction shall conform to the following specific requirements:

(a) All compression members shall be proportioned by the usual formula, 16,000-70 l except that the length of the main or principal members R may be increased to one hundred and seventy-five (175) times the least radius of gyration, and the length of all secondary or sub-members may be increased to two hundred (200) times the same.

(b) The anchorage of every roof sign shall be designed with a factor of safety not less than two (2), i. e., there shall be at least twice as much weight of masonry or concrete resisting the pull on the anchors as figured from the overturning effect of wind.

(c) The thickness of all structural steel members shall not be less than one-fourth (¼) of an inch.

Chicago, March 15th, 1916.

With reference to Section 743 (h) of the Revised Building Ordinances, the Commissioner has ruled that,

(a) Whenever two or more rows of piles are required, the distance between the center lines shall not be less than the largest diameter of the piles.

(b) When a single staggered row of piles is used, the distance between the center lines shall not be less than one-half the largest diameter of the piles, except that in one-story buildings or walls less than twenty feet high a single row without any staggering may be used.

(c) The piles shall be driven so that the distance between centers shall not be less than twice the largest diameter nor two feet six inches minimum.

RULING GOVERNING THE MINIMUM THICKNESS OF METALS.

VIII.

In steel construction exposed to the weather, no metal in principal members shall be less than 5-16 inch thick, except the webs of "I" beams or channels which may be ¼ inch thick but not less. For secondary members, no metal shall be less than 1-4 inch thick, except that webs of channels or "I" beams used as secondary members may be 3-16 inch thick, but not less. This ruling is not to apply to electric signs or fire escapes or canopies.

In steel construction protected by buildings no metal in a principal member shall be less than 1-4 inch thick, except that closed sections filled with concrete and the webs of channels and "I" beams may be 3-16 inch thick, but not less. For secondary members metal may be 3-16 inch, but not less.

The above rulings to take effect August 28 1916.

RULING ON REINFORCED CONCRETE FLOORS.

IX.

In regard to Sec. 776 referring to fireproofing concrete floors, the Commissioner has ruled that the following interpretation shall apply to concrete joist and floor tile construction:

(a) Whenever a combination of reinforced concrete joists and hollow burned clay tile fillers is used, the same shall be assumed same as solid concrete slabs as far as fireproofing of steel rods is concerned.

(b) Whenever a system of concrete joists and steel or plaster domes instead of clay tiles is used, whether same is left in place or withdrawn afterwards, the combination shall be assumed and be subject to same requirements as reinforced concrete beams and girders, with the exception that steel reinforcement in the top of the joists may be considered as in solid slab construction.

(c) Whenever cement plaster ceiling on metal lath is used in connection with the latter type of construction, one-half inch may be deducted from the required amount of fireproofing at the bottom and the sides of joists, provided that cement plaster not less than three-fourths inches thick be applied directly to the under side of joists.

RULING GOVERNING STAR-SHAPED COMPRESSION MEMBERS.

X.

In regard to columns or struts built of two angles placed back to back in star-shape ┘┌, the Commissioner has ruled that the same should comply with the following specifications:

1. Star-shaped compression members shall be tied together by pairs of batten plates or pairs of angle lugs in opposite directions spaced not more than three (3) times the width of main member center to enter of each successive pair.

2. Each batten plate or angle lug shall have enough rivets connecting it to each angle of the column or strut to be able to transfer fifteen (15%) per cent of total stress in the member from one angle to the other through the rivets when these are figured in single shear.

3. Minimum size of rivets shall be as follows:

⅞" diameter for 8" angles.
¾" diameter for 6", 5" and 4" angles.
⅝" diameter for 3" and 2½" angles.

4. Minimum spacing of rivets shall be three (3) inches for single row and two and one-half (2½) inches for double row, staggered, measured parallel to the gage lines. When two gage lines are used, rivets must be staggered.

5. Minimum thickness of strut angles or batten plates shall be one-fourth of an inch (¼) when exposed to weather, and three-sixteenth (3-16) inches when protected within a building, but batten plates or angle lugs shall not be less than two-thirds (2-3) the thickness of the main compression members.

CINDER FILLS ON BUILDINGS.
XI.

Cinder fill on Buildings will be figured at the rate of 66 lbs. per cubic foot unless evidence of exact weight is furnished.

PLATFORMS FOR GRAVITY TANKS.
XII.

Platform beams supporting gravity tanks shall have webs 5/16" thick or more, where the webs are inaccessible for painting the web shall be not less than ⅜" thick.

RIVETS IN TENSION.
XIII.

When rivets are used in tension in wind bracing they may be figured at 18,000 lbs. per square inch if machine driven and 15,000 lbs. per square inch if hand driven.

ROOF ARCHES OF WOOD, STEEL, REINFORCED CONCRETE, STONE OR MASONRY.
XIV.

Use the usual methods given in standard text books on elastic arches fixed or hinged at the ends, for obtaining the critical moments and shears.

The stresses shall be figured on the following basis:—

(1) For the actual dead load acting on the full span of the arch.

(2) For a vertical live load of 25 pounds per sq. ft., acting on such lengths of the arch as will give the maximum moments and shears.

(3) For a horizontal wind-load of 20 pounds per sq. ft. acting on the building and roof. If rollers are used under one end of arch, the wind-load shall be assumed to act on either side of the structure.

(4) For a temperature effect of 50° degrees F. above and below the average.

(5) For the maximum erection stresses possible.

For loadings (1) and (2) combined the stresses shall not exceed those given in the Ordinance.

For the critical combination of loadings (1) and (2) with the others, the stresses given in the Ordinance may be increased fifty per cent.

The arch shall be considered as a column of a length around a vertical axis equal to the spacing of the bracing struts, and of a length around a horizontal axis equal to one-half the length of the arch.

STATE ZONING LAW

Senate Bill 125

(See city ordinance passed July 21-1919 Page 245)

For an Act to confer certain additional powers upon city councils in cities and presidents and boards of trustees in villages and incorporated towns concerning buildings and structures, the intensity of use of lot areas, the classification of trades, industries, buildings, and structures, with respect to the location and regulation, the creation of districts of different classes, and the establishment of regulations and restrictions applicable thereto.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: In addition to existing powers, and to the end that adequate light, pure air and safety from fire and other dangers may be secured, that the taxable value of land and buildings throughout the city, village or incorporated town, may be conserved, that congestion in the public streets may be lessened or avoided, and that the public health, safety, comfort morals and welfare may otherwise be promoted, the city council in each city, and the president and board of trustees in each village and incorporated town shall have the following powers:

To regulate and limit the height and bulk of buildings hereafter to be erected; to regulate and limit the intensity of the use of lot areas, and to regulate and determine the area of open spaces, within and surrounding such buildings; to classify, regulate and restrict the location of trades and industries and the location of buildings designed for specified industrial business, residential and other uses; to divide the entire city, village or incorporated town into districts of such number, shape, area and of such different classes (according to use of land and buildings, height and bulk of buildings, intensity of the use of lot areas, area of open spaces, or other classification) as may be deemed best suited to carry out the purposes of this Act; to fix standards to which buildings or structures shall conform therein; to prohibit uses, buildings or structures incompatible with the character of such districts respectively; and to prevent additions to and alteration or remodeling of existing buildings or structures in such a way as to avoid the restrictions and limitations lawfully imposed hereunder. In all ordinances passed under the authority of this Act, due allowance shall be made for existing conditions, the conservation of property values, the direction of building development to the best advantage of the entire city, village or incorporated town, and the uses to which property is devoted at the time of the enactment of any such ordinance. The powers by this Act given shall not be exercised so as to deprive the owner of any existing property of its use or maintenance for the purpose to which it is then lawfully devoted.

Section 2. The city council in cities and the president and board of trustees in villages and incorporated towns, which desire to exercise the powers conferred by this Act, shall provide for a zoning commission whose duty it shall be to recommend the boundaries of districts and appropriate regulations to be enforced therein, such commission to be appointed by the mayor or president of the board of trustees, subject to confirmation by the council or board of trustees. Such commission shall prepare a tentative report and a proposed zoning ordinance for the entire city, village or incorporated town. After the preparation of such tentative report and ordinance, the commission shall hold a hearing there-

on and shall afford persons interested an opportunity to be heard. Notice of such hearing shall be published at least fifteen (15) days in advance thereof in a newspaper of general circulation in such city, village or incorporated town; or, if there is no such newspaper, such notice shall be posted at least fifteen (15) days in advance thereof in four conspicuous places within the city, village or incorporated town. Such notice shall state the time and place of the hearing and the place where copies of the proposed ordinance will be accessible for examination by interested parties. Such hearing may be adjourned from time to time.

Within thirty (30) days after the final adjournment of such hearing the commission shall make the final report and submit a proposed ordinance for the entire city, village or incorporated town to the city council or board of trustees, as the case may be. The city council or board of trustees may enact the ordinance with or without change, or may refer it back to the commission for further consideration. The zoning commission shall cease to exist upon the adoption of a zoning ordinance for the entire city, village or incorporated town.

Section 3. All ordinances passed under the terms of this Act shall be enforced by such officer of the city, village or incorporated town as may be designed by ordinance. Each city, village or incorporated town exercising the powers conferred by this Act shall provide by ordinance for the creation of a board of appeals of not less than three members nor more than five members to be appointed in the same manner as the zoning commission. Such board of appeals shall have power: (a) Upon application to review the actions of the enforcing officer of the city, village or incorporated town in order to determine whether they are in accordance with the terms of ordinances enacted under the terms of this Act; (b) to recommend to the city council or board of trustees such ordinances or amendments as it may deem necessary or desirable, including power in specific cases of particular hardship to recommend variations of the original ordinance or amendments thereto. Variations from or amendments to ordinances enacted under the terms of this Act shall in all cases be made by ordinance.

Section 4. The regulations imposed and the districts created under the authority of this Act may be varied or amended from time to time by ordinance after the ordinance establishing same has gone into effect, but no such variations or amendments shall be made without a hearing before the board of appeals, provided for by Section 3 hereof. Such board shall give notice and proceed in the same manner as is provided by Section 2 with respect to the zoning commission. Upon its report the city council or board of trustees may adopt the proposed variation or amendment, with or without change, or may refer it back to the board for further consideration. Any proposed variation or amendment which fails to receive the approval of the board of appeals shall not be passed except by the favorable vote of two-thirds of all the members of the city council in cities or of the members of the board of trustees in villages or incorporated towns. In case of written protest against any proposed variation or amendment, signed by the owners of twenty per cent of the frontage proposed to be altered, or by the owners of twenty per cent of the frontage immediately adjoining or across an alley therefrom, or by the owners of twenty per cent of the frontage directly opposite the frontage, proposed to be altered as to such regulations or district, filed with the said board of appeals, or with the city council or board of trustees, such variation or amendment shall not be passed except by the favorable vote of two-thirds of all the members of the city council in cities or of the members of the board of trustees in villages or incorporated towns.

Section 5. "An Act to confer certain additional powers upon city councils in cities and presidents and boards of trustees in villages concerning buildings, the intensity of use of lot areas, the classification of buildings, trades and industries with respect to location and regulation, the creation of residential, industrial, commercial and other districts, and the exclusion from and regulation within such districts of classes of buildings, trades and industries," approved June 28, 1919, in force July 1, 1919, is repealed. This repeal shall in no way affect the validity of steps taken or acts done under the Act so repealed. No acts done in compliance or supposed or attempted compliance with the Act so repealed shall be rendered void or of no effects because of omissions, defects or irregularities, if such acts are in compliance with the requirements of this Act.

RESIDENCE DISTRICTS: TEMPORARY WITH-HOLDING OF BUILDING PERMITS.

Be it ordained by the City Council of the City of Chicago:

Passed July 21, 1919.
Amended September 9, 1919.

Section 1. That in all cases where an application for a permit is made for the erection of a new building in any block in which a majority of the buildings are used exclusively for residence purposes, or in a block on the opposite side of the block so used for residential purposes, if there shall be filed with the Commissioner of Buildings a protest signed by not less than ten owners of property in such block so used for residential purposes, or in case the majority of the frontage is owned by less than twenty persons then by a majority of the owners according to frontage, the Commissioner of Buildings shall withhold the issuance of a building permit until the City Council shall have ordered a public hearing in accordance with an act of the General Assembly entitled "An Act to confer certain additional powers upon city councils in cities and Presidents and boards of trustees in villages concerning buildings, the intensity of use of lot areas, the classification of buildings, trades and industries with respect to location and regulation, the creation of residential, industrial, commercial and other districts, and the exclusion from and regulation within such districts of classes of buildings, trades and industries," in force July 1, 1919. For the purposes of this ordinance a block shall be understood to be a plot of ground containing city lots surrounded by public streets, railway rights-of-way, natural boundaries or public places or thoroughfares.

Section 2. This ordinance shall take effect and be in force from and after its passage and approval.

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DEPARTMENT OF ELECTRICITY, CITY OF CHICAGO

Particular attention is called to the various important requirements of the Ordinances printed herein.

Permits will be issued only to licensed electricians.

A licensed electrician can do work only in the class for which he is licensed. Application should not be made to do work in any other class.

Licenses may be transferred from one class to another by paying the difference between the original license fees and the difference between the renewal fees for the unexpired portion of the license period. The supervising electrician must submit himself to an examination in the new class to which transfer is desired.

Licenses which are allowed to lapse will, on renewal, be dated back to the date of expiration of the previous license, but no license will be renewed after one year from date of expired license.

Bonds must be furnished before the issuance of all classes of licenses except maintenance licenses. The term of the bond must correspond with the period of the license to be issued. Bond must be properly executed and forwarded to the Electrical Inspection Bureau, together with the renewal fee. No license will be issued until the required bond is furnished and where such bond is not supplied permits will not be issued to the licensee.

Inspection fees must accompany applications, otherwise permits cannot be issued.

Applications for permits must be correctly and completely filled out and must be signed by the Supervising Electrician, otherwise application must be returned and work delayed.

In all cases the location must be completely and correctly stated. If in an office building or other building having a number of floors, the floor or room number must be given. Where necessary the prefix East, West, North or South must be given. Failure to comply with this requirement confuses the records of the office and results in inconvenience and delays to the contractor and the public.

Application must be made only for the work contracted for and installed by the licensee. The obtaining of permits for work done by others will be considered cause for revocation of license.

Where apparatus is installed in addition to that originally applied for, full fee will be charged for such apparatus.

Permits must be obtained **before** any work is started. Violation will be considered as sufficient cause for revocation of license.

The wiring contractor must connect up all switches and receptacles installed by him. He must also pole up all wires at fixture outlets and must solder and tape all such wires except those to which a fixture is to be attached.

The use of electric current is prohibited previous to the issuance of a current permit or certificate.

Temporary work must be inspected and approved before current is used on the same.

Alterations to existing wiring must not be made without obtaining a permit.

Violation of the ordinance constitutes a misdemeanor and is punishable by a fine of from $50.00 to $100.00, also by the cutting off and stopping the use of current.

GEORGE E. CARLSON,
Commissioner of Gas and Electricity.

SPECIAL SUGGESTIONS TO ARCHITECTS.

The Department of Electricity will **not allow more than sixteen (16) sockets to be attached to one circuit.**

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 40 watt or equivalent.

Frequently the fixture contractor installs more than sixteen lights on a circuit, which is in violation of the city ordinances, and causes the consumer very much annoyance in getting electric current to his premises.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hanger to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

SPECIAL NOTICE.

Service switches, cutouts and meters must, when practicable, be placed in basements or other public portions of the building. Exception will be made for cutouts in the case of apartment buildings having 4 circuits or more per apartment or where the building is four stories or more in height. Where cutouts are located in apartments or on the various floors of residences, etc., they must never be located in clothes closets or any other location where combustile material is stored.

Service switches, cutouts and meters should not be installed above or in close proximity to laundry tubs, sinks, gas meters or plumbing fixtures.

Meter outlet fittings must be of approved construction.

A separate fitting is required for each meter.

Meter fittings are required on all installations where the mains are of No. 2 B. & S. gauge or smaller. This includes both power and light.

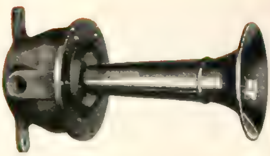
On mains larger than No. 2 B. & S. gauge, conduit fittings, where wires leave the conduit system through separate insulated openings, must be used.

The meter fitting must be placed so that the opening for the wires is at the top of the fitting, except where the fitting is so constructed that the wires to meter leave at the side.

All wires from fitting to meters where liable to come in contact with wires or other materials must be protected by flexible tubing.

R. L. M. Dome Reflector Socket

Gas and Vapor-Proof Fixture



Industrial Signal

Bowl Shade Holder Reflector

REFLECTOR SOCKETS.—Benjamin Reflector Sockets are seamless, made of one piece of steel and will successfully resist the influences of corrosion. Furnished in R. L. M., Bowl, Shallow Bowl and Flat cone shapes, to meet all lighting requirements. Porcelain enameled, green outside, white inside.

SHADE HOLDER REFLECTORS.—Intended for use principally where sockets are already installed. Fit any standard porcelain or brass shell socket, 2¼-inch shade holder, or the "Benco" threaded socket. R. L. M., Bowl, Shallow Bowl, or Symmetrical Angle shapes. Porcelain enameled, green outside, white inside.

Elliptical Angle Reflector

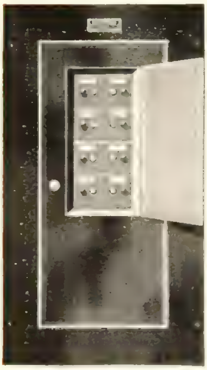
ELLIPTICAL ANGLE REFLECTORS AND PARABOLITES.—Elliptical Angle Reflector is used where a vertical surface must be lighted or where overhead mounting is not possible. Parbolite is used to light narrow aisles, corridors, areas adjacent to fences, etc. Sockets included. Porcelain enameled, black outside, white inside.

"Benco" Weatherproof Socket

"BENCO" WEATHER-PROOF SOCKETS.—"Benco" Weatherproof Sockets are highly insulated metal cased sockets for indoor and outdoor service. Keyless or pull chain types. Fit Type "S" shade holder reflectors. Finished in frosted aluminum, brushed brass, natural copper, or green to match reflector.

GAS AND VAPOR-PROOF FIXTURES.—Benjamin protective lighting units. For use in powder, benzol and paint plants, garages, gasoline filling stations, etc. Flat Cone or Dome reflector and without reflector. Metal parts galvanized, reflector green porcelain enameled outside, white inside.

INDUSTRIAL SIGNALS.—Benjamin Industrial Signals have a peculiar, penetrating tone pitch, which makes them more effective as audible signals than gongs or bells. A special adjusting means governs volume and tone pitch. A large number of devices—one for every industrial application.



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BENJAMIN-STARRETT PANEL BOARDS.—Built upon approved composition bases, with concealed bus bars. Stronger, smaller, lighter—quickly procured, easily installed. Open and Dead Front Standardized Panel Boards from 4 to 30 circuits, Open and Dead Front Residence Panel Boards from 2 to 10 circuits.

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London, England

SECTIONS OF THE CHICAGO CODE OF 1911 OF THE CITY OF CHICAGO GOVERNING ELECTRICAL INSPECTIONS

Passed March 13, 1911.

Amended December 30, 1912; July 7, 1913; July 21, 1913; November 3, 1913; July 21, 1919; July 22, 1921.

CHAPTER XXIV. ELECTRICITY — ARTICLE 1. DEPARTMENT OF GAS AND ELECTRICITY.

"830. **Electric Current.)** No electric current shall be used for lighting, heating or power purposes except as hereinafter provided.

"831. **Applications — Contents — Permit.)** All persons or corporations desiring to install wires or other apparatus for the use of electrical currents for any of the purposes mentioned in the foregoing section, shall, before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefore in the office of the Commissioner of Gas and Electricity, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number, such application to be countersigned by the person under whose supervision the work is to be done; and upon the filing of said application, if found proper, such permit shall be given, and no work shall be started until such permit has been obtained. No work shall be done unless under the supervision of a duly qualified person as provided in Section 832.

"832. **Requirements for License—Classification—Suspension and Revocation of License.)** Any person or corporation making application for permits must first file with the Commissioner of Gas and Electricity an application containing an affidavit stating that the work to be done under such permits will be under the supervision of a person who is not less than twenty-one (21) years of age, who has a thorough knowledge of electrical construction and who has had not less than four (4) years of practical experience in installing or maintaining electrical wires and apparatus in the class mentioned in the application for license and provided for in the classification of licenses as given below, and who shall have regularly passed the examination as provided for hereinafter. Such application shall be made upon a form prepared and approved by the Board of Examiners to be appointed by the Mayor for the purpose of inquiring into and ascertaining the qualifications of such applicant and of the Supervising Electrician, as provided herein. Such application shall contain the name and signature of the person under whose supervision the work is to be done, together with two indorsements from responsible citizens, made under oath, that such person possesses the qualifications above designated. Upon filing such application in proper form and upon the deposit of an amount equal to the license fee for the class of license being applied for, with the said Examining Board, and upon the Supervising Electrician successfully passing the examination hereinafter provided for, the said Examining Board shall cause to be transferred to the City Collector the deposit made by such applicant, which deposit the said City Collector shall receive as the license fee for the said applicant, and the Commissioner of Gas and Electricity shall issue, or cause to be issued, the license applied for, which license shall entitle the licensee to obtain permits to do such work as shall be within the classification covered by such license. The license fee for the first year for a General Electrical Contractor shall be two hundred dollars ($200.00) with a renewal fee of fifty dollars ($50.00) for each year. The license fee for the first year for Electrical Construction shall be one hundred dollars ($100.00) with a renewal fee of twenty-five dollars ($25.00) for each year. The license fee for the first year for a fixture license, including such persons or corporations doing fixture work only, shall be one hundred dollars ($100.00) with a renewal fee of twenty-five dollars ($25.00) for each year. The license fee for the first year for a sign license, including such persons or corporations doing sign work only, shall be twenty-five dollars ($25.00) with a renewal fee of ten dollars ($10.00) for each year. The license fee for the first year for a maintenance license, including such persons or corporations doing maintenance work in buildings owned or controlled by such persons or corporations, shall be twenty-five dollars ($25.00) with a renewal fee of ten dollars ($10.00) for each year. The above classification of licenses and the fees pertaining thereto shall not immediately apply to those certificates of registration in existence at the time of passage of this ordinance but shall apply to such certificates of registration at the expiration of the period for which they are issued at which time a renewal fee in accordance with the above classification must be paid before such renewal is made.

Prior to the issuance of a license for General Electrical Contractor, Electrical Construction, Fixture License and Sign License, the applicant shall file with the City Collector of the City of Chicago, an indemnifying bond with good and sufficient sureties in the penal sum of five thousand dollars ($5,000.00), and bond being payable to the Commissioner of Gas and Electricity of the City of Chicago, for the use of any persons or corporations with whom such applicant shall thereafter contract to do work, to indemnify any such persons or corporations for damages sustained on account of the failure of such applicant to perform the work so contracted for,

ECONOMY
renewable FUSES

Cartridge

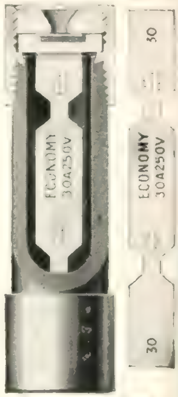
Economy "Drop Out" Renewal Link and Winged Washer

Knife Blade Type Disassembled

ECONOMY FUSES are made in three general types (ferrule, plug, and knife blade), with a full line of capacity ranges for all commercial voltages. This was the first line of fuses employing an inexpensive bare link for restoring a blown fuse to its original efficiency to be approved in ALL CAPACITIES by the Underwriters' Laboratories, Inc., established and maintained by the National Board of Fire Underwriters.

The fusible elements are of the "Drop Out" renewal link type, accurately rated and of definite design. In operations on short circuits the entire fuse metal does not volatilize; only the two narrow bridges of metal that hold the drop out portion fuse. There is no powdered filler to deteriorate or to solidify. The winged washer makes replacement of link quick and easy.

Since every part of an Economy Fuse excepting the link is good for years of service, their use will give an annual saving of 80 per cent in fuse maintenance costs compared to one-time fuses.

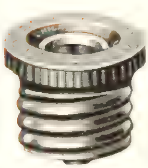


Ferrule Type and "Drop Out" Link

Write "Economy Fuses" Into Your Specifications for Electrical Fusing.

ECONOMY ELEXITS	**Economy Elexit Devices are now in process of manufacture and being marketed through Economy Fuse & Mfg. Company's own sales organization. Write for Circular LX, detailing advantages of Elexits to the architect.**	***"Hang a Fixture Like a Picture"***

CLEAR SITE Plug Fuses



Clearsite Fuses abolish all trouble in locating blown fuses on small branch electrical circuits.

This fuse represents the highest form of convenience in the art of fuse manufacture. It is the only non-renewable plug fuse using the famous Economy "Drop Out" Link, which greatly reduces the internal operating pressure.

The clear window makes it easy to see the link—with the amperage stamped thereon—and when the fuse has blown on overload a gap in the operative section is plainly discernible. When blown on short circuit the blackened window renders vision of the link impossible. There is no doubt of the condition of Clearsite Fuses at all times. Packed in standard carton quantities, and in retail packages of four fuses.

ECONOMY FUSE & MFG. CO.

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in accordance with the provisions and requirements of the City of Chicago, relating to the installing, operating and maintaining of electrical wires or apparatus. The filing of the above mentioned bond shall be required previous to the issuance of any original license or the renewal of any certificate of registration in existence at the time of passage of this ordinance.

For the purpose of ascertaining the qualifications of the applicant and of the Supervising Electrician, the Mayor shall appoint an Examining Board of five (5) members to consist of the following: Commissioner of Gas and Electricity, chairman, one member to be selected from the Board of Underwriters of the City of Chicago, one member to be a General Electrical Contractor, regularly engaged in the contracting business in the City of Chicago, one member to be a journeyman fixture hanger, who has had at least five (5) years of practical experience in general fixture work, and one member shall be a journeyman electrician who has had at least five (5) years of practical experience in general electrical work. Each member of said Examining Board, with the exception of the Commissioner of Gas and Electricity, shall receive as his compensation as such, the sum of ten dollars ($10.00) per day for each day, not to exceed thirty (30) days per year, that he shall be actively engaged in the business of the Examining Board, and such compensation shall be paid out of the corporate funds. Such members shall hold office for a period of one year or until their successors are duly appointed. Provided, further; a clerk shall be assigned by the Commissioner of Gas and Electricity to assist the said Examining Board in its work and such clerk shall be a Civil Service employee. Provided, further, that the said Examining Board shall have power to adopt the necessary rules and regulations for the licensing of electricians and for the examination of Supervising Electricians and such examination shall be conducted by the said Board by the oral and written method and the judgment of the said Board as to whether or not an applicant or Supervising Electrician is qualified and has sufficient experience and knowledge for the particular class of license applied for shall be final.

Licenses shall be classified as follows: General Electrical Contractor, Electrical Construction, Fixture License, Sign License and Maintenance License. Under the classification of General Electrical Contractor shall be included persons or corporations doing all classes of electrical work in which shall be included general electrical contracting, electrical construction, fixture, sign and maintenance work. Under the classification of Electrical construction, fixture, sign and maintenance work. Under the classification of Eleccal work excepting electrical fixtures and electrical signs. Under the classification of Fixture License shall be included persons or corporations doing electrical fixture work only. Under the classification of Sign License shall be included persons or corporations doing illuminated sign work only. Under the classification of Maintenance License shall be included persons or corporations doing maintenance work only in buildings owned or controlled by such persons or corporations.

Where a Certificate of Registration is in existence at the time of passage of this ordinance a renewal of such Certificate shall only be made within the classification previously placed on such Certificate by the Commissioner of Gas and Electricity, and for the purpose of transferring to or renewing a Certificate of Registration in any other class, as provided for herein, the Supervising Electrician must submit to, and properly pass, an examination such as will determine his experience and qualifications to act as Supervising Electrician in the particular class of business to which he desires to transfer.

Where a license is permitted to lapse by failure on the part of the licensee to renew same on or before the date of expiration the renewal of same will date back to the date of expiration of the expired license, and no license shall be renewed after a period of one year from date of expiration.

All licenses issued under the provisions of this ordinance shall be transferable. All such transfers shall be registered with the Examining Board and with the Commissioner of Gas and Electricity. Such transfers, however, shall not be made until such time as transferee has complied with all the terms of the ordinances of the City of Chicago. The Supervising Electrician may be replaced at any time with any other Supervising Electrician who shall comply with the terms of this ordinance and no fee shall be charged for such transfer.

For the purpose of conducting examinations and for the transaction of business, the Board of Examiners shall hold its meetings when it shall deem necessary. All applications for license shall be submitted by the applicants to the Board and placed on file at least fifteen days (15) days before the time set for holding the examination and such applications shall be acted upon by the Board within forty-five (45) days from date of filing.

The Board of Examiners, upon complaint being made to it by the Commissioner of Gas and Electricity respecting the character of the work done by any licensee, shall have the power, and it shall be its duty, to cause such licensee or his Supervising Electrician to appear before the said Board for the purpose of examination. If such Board shall find the licensee or Supervising Electrician is not qualified to do the work for which he has been licensed or that such licensee or Supervising Electrician has not complied with the ordinances of the City of Chicago, or with the rules and regulations of the Department of Gas and Electricity, in the performance of his work, it shall be the duty of the said Board to certify such facts to the Commissioner of Gas and Electricity with a recommendation for the suspension or revocation of the license as the Board shall in its judgment deem advisable.

The Commissioner of Gas and Electricity may, for any violation of the provisions of this article, or of any rule or regulation of the Department of Gas and Electricity of which the licensee has received notice, suspend the license of such licensee for a period not to exced thirty (30) days. The Mayor may revoke the license of any licensee for violation of any ordinance of the City of Chicago relative to the installation, operation or maintenance of electrical wires or apparatus, or if in his discretion the holder of such license is incompetent or unfit.

"833. **Duties of Commissioner of Gas and Electricity Thereon.)** The said Commissioner of Gas and Electricity, or his assistants, shall have power, and it shall be their duty, when deemed necessary by the Commissioner of Gas and Electricity, to carefully inspect any such installation previous to and after its completion, and they shall have the right to enter any building when by them deemed necessary, to inspect any such installation, and it shall be competent for them to remove any existing obstructions which may prevent a perfect inspection of the current-carrying conductors, such as laths, plastering, boarding or partitions; and it shall be unlawful for any person to interfere with them in the performance of their duties; and if such installation shall prove to have been constructed in a safe and secure manner, after the payment of a fee, as hereinafter provided, the Commissioner of Gas and Electricity shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of such inspection. Any owner installing or causing

CHICAGO FUSE MFG. COMPANY

Manufacturers of FUSES, FUSE PLUGS, SWITCH and OUTLET BOXES, CUT-OUT BASES

CHICAGO, ILL. NEW YORK, N. Y.

Ferrule Type


"Union" Renewable Fuse, Knife Blade Type

"UNION" RENEWABLE AND NON-RENEWABLE FUSES

Both the renewable and non-renewable types have the unqualified approval of the National Board of Fire Underwriters in all sizes of N. E. C. Standard dimensions for both 250 and 600 volt service, and bear their inspection label.

The tubes of "Union" fuses are made of special extra thick fire-resisting fiber of unusual strength.

Ferrules of the knife blade type, which form one piece with the caps, are screwed to the outside of tube and permanently fastened in the right position by a rivet, insuring permanent alignment of the blades. In renewing, this connection to the tubing is not disturbed, as all changes are made between the long wearing metal surfaces.

The flexibility of the knife blade fastenings allows the blades to readily adjust themselves in the mounting clips, and so make good contact. Both knife blades are in perfect alignment. This prevents overheating of terminals, preventing possible destruction of fuse.

The yoke is riveted to the knife blade, forming a rigid baffle plate. Washers are heavy die-cut pieces accurately slotted so they can be easily lifted off with the fingers.

There is no flash or violent explosion when the fuse blows. Metal parts can not fuse, as they are treated by a special process that prevents it.

In addition, the fusing point in the link is in the center, too far from metal parts to enable heat and gases to fuse and corrode them.

Arcing and electro-metallic deposits can not occur, because the entire center of the link melts completely when a fuse blows and leaves a wide space.

We put vents, or "safety valves," in the ends of sizes that might require them, to permit gases to escape quickly.

The simple construction, with lack of intricate parts, makes the "Union" the easiest and quickest fuse to renew.

Links of the ferrule type are supplied with one end bent to save time and insure accurate insertion. The heavy metal parts insure cool running. Official tests on both the 30 and 60 ampere sizes show that their temperatures run much below the limits specified by the Underwriters' Laboratories standard.

No tools of any kind are required to renew the ferrule type; while the knife blade type can be renewed by the use of a screwdriver or wrench.

Exceptionally rugged construction throughout insures extraordinarily long life. Consequently the "Union" saves more than any other renewable fuse.

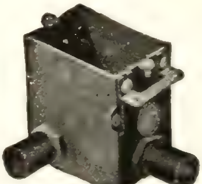
Both of these types are for sale by all leading electrical supply jobbers and dealers.

Our 96-page illustrated Catalogue No. 29 sent on request.

"GEM" SECTIONAL SWITCH BOXES

These boxes, with the exception of Nos. 155, 160 and 170, are equipped with reversible and sliding ears, suitable for either old or new work. All types are made from No. 14 U. S. gage steel and are accurately spaced to take Standard push button switches and receptacles. All types are put together in an exceptionally rugged manner. The "GEM" boxes have both sides removable and can be built into gangs by simply removing the unnecessary sides and attaching the bodies together.

Complete details of construction, also information regarding clamps, solid gang tandem boxes, door switch boxes and bushings, may be found in Catalogue No. 29, which will be sent with prices and discounts on request.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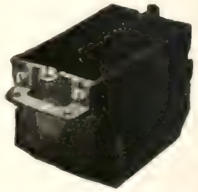

Gem E

to be installed any electric wires to be hidden from view shall, prior to such installation, give said Commissioner of Gas and Electricity a reasonable notice in order to give ample time for inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of such certificate; provided, however, the Commissioner of Gas and Electricity may issue a temporary permit for the use of electrical current during the course of construction or alteration of buildings, which permit shall expire when the electrical apparatus for such building is fully installed. The Commissioner of Gas and Electricity may, in his discretion, receive a single deposit from one or a number of different persons, firms or corporations to guarantee the payment of inspection fees as imposed by the ordinance of the City of Chicago, and in such case shall, at the time of receiving such deposit, enter into an agreement with the persons, firms or corporations, on behalf of whom said deposit is made, wherein among other conditions shall be stated the purpose for which said deposit is made and on whose behalf, and such agreement shall provide that in case said deposit is anywise depleted to the extent of twenty-five per cent (25%), the persons, firms or corporations on whose behalf said deposit is made shall, within three days after notice of such depletion given by the head of such department to any one of such persons, firms or corporations on whose behalf said deposit is made, deposit a sufficient sum to replenish said fund so that the amount shall be equal to that originally deposited; and provided, whenever any notice to replenish a deposit shall have been given as herein provided, and said deposit shall not be replenished as herein provided, no permit shall thereafter issue to any of the persons, firms or corporations on whose behalf said deposit was made, unless such peson, firm or corporation shall first deposit a sum as provided by the ordinances pursuant to which such permit is issued.

"834. **Power of Commissioner of Gas and Electricity—Inspections and Re-Inspections.)** The said Commissioner of Gas and Electricity is hereby empowered to inspect or re-inspect all overhead, underground and interior wires, and apparatus conducting electric current for light, heat, or power, and when said conductors or apparatus are found to be unsafe to life or property, he shall notify the person or corporation owning, using or operating them to place the same in a safe and secure condition within forty-eight hours. Any person or corporation failing or refusing to repair, change or remove the same within forty-eight hours or within such further time as the Commissioner of Gas and Electricity shall determine is necessary, after the receipt of such notice, shall be subject to the penalty hereinafter provided.

Whenever it shall be necessary in the opinion of the Commissioner of Gas and Electricity to call upon the department of police for aid or assistance in carrying out or enforcing any of the provisions of the City of Chicago governing electrical inspections, he shall have authority to do so, and it shall be the duty of the department of police or any member of said department, when called upon by said Commissioner of Gas and Electricity, to act according to the instructions of and to perform such duties as may be required by said Commissioner of Gas and Electricity in order to enforce or put into effect the provisions of these rules and regulations.

"835. **Poles—Covers — Wires — Electric Service Entrances—Switches.)** All poles now standing or hereafter erected, and all covers for manholes now in service, or hereafter placed in service for the use of electric conductors, shall be branded or stamped with the name of the person or corporation owning the same; all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner, and giving such a full description of the conductors as shall meet with the approval of said Commissioner of Gas and Electricity; and all of said electric service entrances shall be properly equipped with approved cutout service switches. Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

"836. **Fees.)** (See Tables of Fees, Pages 266 to 269.) There shall be paid by the registered electrician and collected by the City Collector prior to the issuance of any permit to do electrical work, inspection fees in accordance with the following classification:

Wiring Only for Lighting Circuits. (Not including Fixtures, Sockets or Receptacles.) For the inspection of each complete branch lighting circuit of 1,000 watts or less: one dollar and fifty cents for one circuit, one dollar and twenty cents for each of the next four circuits, one dollar for each of the next five circuits, eighty-five cents for each of the next five circuits, seventy-five cents for each of the next five circuits, sixty-five cents for each of the next five circuits and sixty cents for each succeeding circuit. (Effective September 1, 1921.)

For the inspection of each complete branch lighting circuit of larger capacity than 1,000 watts the charge shall be in proportion to the wattage of such circuit. (Effective September 1, 1921.)

For the inspection of additional outlets on existing circuits: ten cents for each outlet on which a socket, receptacle or fixture will be attached. (Effective September 1, 1921.)

Electrical Fixtures, Sockets and Receptacles. (Not including the circuit feeding same.) For the inspection of fixtures, sockets or receptacles for lamps of nominal fifty watts capacity; one to fifteen lamps, fifty cents; sixteen to twenty lamps, seventy-five cents; twenty-one to twenty-five lamps, one dollar; twenty-six to thirty lamps, one dollar and twenty-five cents; thirty-one to forty lamps, one dollar and fifty cents; forty-one to fifty lamps, one dollar and seventy-five cents; fifty-one to sixty lamps, two dollars; sixty-one to seventy lamps, two dollars and twenty-five cents; seventy-one to eighty lamps, two dollars and fifty cents; eighty-one to ninety lamps, two dollars and seventy-five cents; ninety-one to one hundred lamps, three dollars; one hundred and one to one hundred and ten lamps, three dollars and twenty cents; one hundred and eleven to one hundred and twenty lamps, three dollars and forty cents; one hundred and twenty-one to one hundred thirty lamps, three dollars and sixty cents; one hundred and thirty-one to one hundred and forty lamps, three dollars and eighty cents; one hundred and forty-one to one hundred and fifty lamps, four dollars; one hundred and fifty-one to one hundred and sixty lamps, four dollars and twenty cents; one hundred and sixty-one to one hundred and seventy lamps, four dollars and forty cents; one hundred and seventy-one to one hundred and eighty lamps, four dollars and sixty cents; one hundred and eighty-one to one hundred and ninety lamps, four dollars and eighty cents; one hundred and ninety-one to two hundred lamps, five dollars; above two hundred lamps, twenty-five cents for each group of twenty-five lamps or less. For lamps of larger or smaller capacity the charge shall be in proportion to the wattage of the lamp.

Wiring and Fixtures. For the inspection of both circuit wiring and fixtures, sockets

or receptacles: The aggregate sum of the fees as shown above for wiring and for electrical fixtures.

Motors and Other Forms of Power. For the inspection of each electrical horsepower of seven hundred and forty-six watts used for mechanical or other purposes than above mentioned, the sum of one dollar for each horsepower from one to five horsepower, inclusive; for each of the next succeeding five horsepower, seventy-five cents; for each of the next succeeding five horsepower, sixty-five cents; for each of the next succeeding ten horsepower, fifty-five cents; for each of the next succeeding twenty-five horsepower, fifty cents; for each of the next succeeding two hundred horsepower, twenty-five cents; for each of the next succeeding two hundred and fifty horsepower, ten cents; and for each additional horsepower, five cents.

Temporary Work, Outside Work, Etc. Inspections of electric lights, other than electric signs as herein defined, placed on a public street or alley for the purpose of illuminating the same, temporary installations for show window exhibitions, conventions and the like, underground or overhead wires and apparatus, and all other inspections not specifically provided for herein, shall be charged for according to the time required for such inspection at the rate of one dollar per hour.

Note: The ordinance requires the payment of the inspection fee previous to the issuance of the permit. In the case of "time" charges the amount of the fees cannot be determined until after the inspection has been completed. In such cases a uniform fee of $1.50 should accompany the application for permit and a bill will be mailed for the balance of the fee after the final inspection has been made.

Re-Inspections. Each re-inspection of any overhead, underground or interior wires or apparatus shall be charged for according to the time required for such re-inspection at the rate of one dollar per hour.

Note: The inspection charge of $1.00 per hour for time will only be applied on the inspection of incandescent and arc lamps in the following instances:

a. Re-inspection on alterations and repairs where the location of the lamps is not changed or where new lamps are not added. By "alterations and repairs" is meant only such minor changes as may be necessary to place an existing installation in safe condition. It does not include either extensive or complete rewiring.

b. Replacing of fixtures where the circuit wiring is not changed or where the number of lamps, or the total connected wattage of the lamps is not increased over the original installation.

c. Commercial street lighting.
d. Temporary installations for show window exhibitions, conventions, and the like.

All inspections other than those noted above will be charged on the basis of the number of lamps wired for and at the full rate as specified for new work. In no case will credit be allowed for lamps replaced except in the case of replacing fixtures as specified above.

Extra Inspections. Where extra inspections are made on account of any of the following reasons a charge of one dollar shall be made for each such inspection; inaccurate or incorrect information, failure to make necessary repairs, faulty constuction.

Minimum Fee. No inspection shall be made for a less amount than one dollar.

On each installation where a permit has been issued and work not sufficiently completed within three months for wiring only certificate to be issued, and where inspection has been made on such work, a portion of the regular fee must be charged to cover the cost of such inspection, which will be credited on the final certificate.

The Commissioner of Gas and Electricity shall make a fee bill, in duplicate, on a form to be approved by the City Comptroller, and shall forward the same to the Comptroller to be recorded and rendered. The person, or corporation, receiving the fee bill shall pay the amount thereof to the City Collector, who shall endorse payment thereon and enter the fee bill and payment in a book in his office, to be provided for that purpose, and thereupon the City Collector shall deliver the paid fee bill to the person or corporation paying the same. The Commissioner of Gas and Electricity shall thereafter issue the certificate as provided for in Section 833.

"837. **Alterations.)** No alterations shall be made in any electrical installation without first notifying the said Commissioner of Gas and Electricity and submitting the same for inspection in the same manner as provided for new work.

* * * * * *

"848. **Penalty.)** Any person or corporation who shall violate any of the provisions of this article or who shall furnish or use any electrical current or install any electrical wires or apparatus within the city in violation of any of the provisions of this article, shall be fined not less than fifty dollars nor more than one hundred dollars for each offense, and each day's use thereof contrary to the provisions of this Article shall constitute and be a separate and distinct offense. Said Commissioner of Gas and Electricity may, for any violation of the provisions of this Article, also order and compel the cutting off and stopping of such current until the provisions of this Article are fully complied with.

ARTICLE II. ILLUMINATED SIGNS.

"850. **General Requirements—Definition.)** It shall be unlawful for any person or corporation to erect or maintain over any sidewalk, street, avenue, alley or public way in the city, any illuminated signs, except in accordance with the ordinances of the City of Chicago.

For the purpose of this Article illuminated signs shall be declared to be signs constructed as follows: Signs, all or any part of the letters of which are made in an outline of incandescent lamps; signs with painted, flush or raised letters, lighted by an electric lamp or lamps attached thereto; signs having a border of incandescent lamps attached thereto and reflecting light thereon; and transparent glass signs whether lighted by electricity or other illuminant.

"851. **Inspection Fees.)** (See Table of Fees. Page 269.) The owner or person having charge or control of any sign authorized by this Article shall pay for the use of the city an annual inspection fee to cover the expense of inspection of such sign, the amount of such fee to be computed according to the following classification and schedule:

Projecting Signs.

The fee for all signs projecting at right angles or obliquely from the building against which same are placed, whether such signs are vertical or horizontal, and not being flat signs as hereinafter described, shall be computed at the rate of fifteen cents per annum per square foot of sign surface on each illuminated side of such signs.

Flat Signs.

The fee for all signs placed against a building and running parallel thereto and not projecting obliquely or at right angles therefrom shall be computed at the following rates:

For the inspection of lamps of nominal fifty watts capacity as follows: For each of the first twenty-five incandescent lamps, ten

REFLECTOLYTE

Standardized Lighting Fixtures


Type S. C.


Type U. C.

Made in six distinct types, to accommodate lamps from 50 to 500 watts.

A large variety of designs, close, suspended, single and multiple types, with brackets to match.


Type Y. B.


Type H. C.

Architecturally and mechanically correct, and of proven efficiency.

Low in first cost, easy to erect, and inexpensive to maintain.


Type P. F.

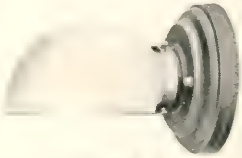

Type J.

Catalog and engineering service cheerfully furnished.

Complete Architectural Data and illustrations in SWEET'S.


Type Y. G.

SEE OUR CATALOGUE IN SWEET'S


Type P. R.

The Reflectolyte Company

Lighting Specialists

914-V Pine Street St. Louis, Mo., U. S. A.

cents; for each of the next twenty-five lamps, nine cents; for each of the next twenty-five lamps, eight cents; for each of the next twenty-five lamps, seven cents; for each of the next one hundred lamps, six cents; for each of the next one hundred lamps, five cents; for each additional lamp above three hundred, four cents. For lamps of larger or smaller capacity the charge shall be in proportion to the wattage of the lamp.

Temporary Signs.

The fee for illuminated signs installed for temporary use for special occasions not to exceed thirty days shall be computed at one-fourth of the annual rate fixed for the particular type or style of sign, whether projecting or flat.

"852. **Application—Permit.)** Any person or corporation desiring to erect and maintain an illuminated sign over any sidewalk, street, alley or public way in the city shall make application to the Commissoner of Gas and Electricity for that purpose on a printed form to be furnished therefor by the Department of Gas and Electricity, setting forth in such printed form such information as is required by said department. Such application when made shall be submitted by the Commissioner of Gas and Electricity to the Commissioner of Public Works for his appoval as to the location of such sign, and when the approval of the Commissioner of Public Works shall be placed upon such application as to the location thereof the Commissioner of Gas and Electricity shall issue to such applicant, upon the payment by such applicant to the City Collector of the inspection or permit fee as herein fixed, a permit in writing, authorizing such applicant to erect a sign at the location designated in such application and of the style or design described therein. Upon the completion of the work of erecting such sign under such permit the applicant shall forthwith notify the Commissioner of Gas and Electricity, who shall thereupon cause an inspection of such sign to be made; and if he shall find that such sign has been constructed and erected in accordance with the ordinances of the City of Chicago, he shall thereupon issue to such applicant a permit in writing authorizing such applicant to operate and maintain the sign so erected for the period of one year from the date of the issuance thereof; such permit to be issued without further cost or expense to the applicant other than the fees hereinbefore provided.

The use of electrical current or of any other illuminant, by such applicant in connection with such sign previous to the issuance of the permit last described, is prohibited and no electrical current, or other illuminant, shall be turned on, or into, such sign, previous to the issuance of such permit, except by order of the Commissioner of Gas and Electricity, for the purpose of testing the same to see whether it is constructed in accordance with, and pursuant to, the provisions of this chapter.

No alteration shall be made on any sign erected or maintained under the authority of this Article unless all the provisions hereof are fully complied with and unless a permit expressly issued for the purpose of allowing such alterations be first secured from the Commissioner of Gas and Electricity.

"853. **Location—Time of Illumination.)** Every sign erected under and pursuant to the provisions of this Article shall be placed at least nine feet above the surface of that part of the public way which any such sign overhangs, and the portion of any such sign nearest to the building against which it is placed shall not be a greater distance than two feet from such building.

No illuminated sign shall be permitted to project beyond the curb line.

All sides of every such sign designed to be illuminated shall be illuminated each and every night for a no less period of time than from dusk until the hour of 9:30 p. m.

The authority granted for the erection of any such sign may be revoked at any time by order of the Mayor or of the City Council, and any inspection to permit fees paid to the city for such sign shall not be refunded in case of any such revocation.

"854. **Compliance with Rules.)** Every sign erected and maintained under and pursuant to the provisions of this Article shall comply with the provisions of this Article, and be installed in a safe and secure manner.

"855. **Penalty.)** Any person or corporation who shall erect or maintain an illuminated sign, or use any electric current or other illuminant in any sign in violation of any of the provisions of this Article shall be fined not less than fifty dollars, nor more than one hundred dollars for each offense, and shall be fined a further sum of ten dollars for each and every day on which he or it shall permit or cause any such sign to be erected or maintained or any electric current or other illuminant to be used therein in violation of any of the provisions of this Article; and in addition to such penalties the Commissioner of Gas and Electricity shall for any violation of any of the provisions of this Article compel the cutting off and stopping of electric current or other illuminant supplied to any such sign, and if deemed necessary or advisable by him he shall order such sign removed.

"710. **Illuminated Roof Signs.)** (Permit to be obtained from Building Department. Fee for electrical inspection same as for Flat Signs, Section 851. To be reinspected annually.)

ENCLOSING LIVE PARTS

All exposed live parts of apparatus must be guarded against accidental contact either by the provision of suitable enclosures or by so locating the apparatus that only electricians duly qualified to handle the same can come in contact with it.

All apparatus, with exposed live contacts which in their ordinary operation produce arcs, must be provided with suitable enclosures or so located that nothing of a combustible nature will be in close proximity to the same.

These rules shall not apply to trolley wires or other exposed live parts which from the nature of their use cannot be enclosed.

It is the intent of this rule to require such protection of live parts of electrical apparatus as will eliminate, as far as possible: (1) Accidents from contact with live parts. (2) Fires which may result from sparks or flames produced in the operation of electrical apparatus.

The protection of live parts against accidental contact will be required on all apparatus where a person not familiar with the electrical apparatus may accidentally come in contact with such live parts.

The protection of arcing contacts will be required on all apparatus so situated that such arcing contacts might produce fires.

Protection of live parts may be obtained by so locating apparatus that the live parts are not easily accessible. This may be accomplished by elevating the apparatus eight feet or more above the floor; by locating the apparatus in an engine room or other location where accessible only to authorized electricians.

Protection of arcing contacts may be obtained by locating such arcing contacts in fireproof locations where there is no liability of combustible material being placed near them.

Where there are live parts which can not be protected by location as described above then such live parts must be provided with such enclosures as will afford the protection required above.

It is intended that the enclosure referred to will be provided in the design of the apparatus and will be supplied by the manufacturer.

The effect of the rule on various classes of apparatus where such apparatus cannot be protected by its particular location as described above, is herewith given:

TERMINALS OF APPARATUS.

Exposed binding posts must not be used unless all live parts of both binding post and connections to the same are so insulated that contact cannot be accidentally made with the live parts.

For portable apparatus using flexible cord connections the conductors may enter the apparatus and be connected directly to the interior conductors if provided with a means of strain relief; or a separable plug may be used with the connecting cord terminating in the separable part. Separable plugs should be so connected that there will be no exposed live parts when the plug is disconnected.

For non-portable apparatus, the design should be such as to allow the direct entrance of conduit to the interior of the apparatus and the connection of the conductors to the interior binding posts or conductors, or a junction box may be attached to the apparatus frame and connections made within it.

For motors, or other apparatus, so installed that a small adjustment of position can be made for belt tension, or similar purpose, a short length of flexible steel conduit or of steel armored cable must be used to allow for the adjustment, and care shall be taken that the fastenings shall be secure and permanent.

MOTORS.

Commutators must be protected against accidental contact. This may be accomplished by guards so designed that accidental contact cannot be made with live parts, or by a special design of the motor itself. Where protection of arcing contacts is required the commutator must be so enclosed that sparks from the commutator cannot get outside the enclosure. If doors or covers are used as guards they must be attached to the motor by hinges.

For protection against contact, openings in guards must not exceed one-half inch in any dimension except when the distance of the live parts from the guard is more than four inches, openings may be not to exceed three-fourths inch. For protection against fire, opening in guards must not exceed one-tenth inch in any dimension. (This protection is not to be considered as affording a means to prevent explosions.) Opening of dimensions exceeding those given above may, where they afford equivalent protection, be accepted by the department.

This ruling applies to motors of all sizes including the smaller types of motors used on electric fans, vacuum cleaners and the various motor-operated household and other appliances.

CONTROLLERS.

Manually operated starting boxes, speed controllers and the like must have enclosures of such design that all live parts are completely enclosed and must be so arranged that the device can be operated from the outside of the enclosure. This protection must be obtained by the design of the device. The placing of a manually operated starting box inside a metal cabinet, where it is necessary to open the door of the cabinet to operate the device, is not acceptable.

Automatic starting boxes and similar electrically controlled devices must be placed in standard cabinets provided with hinged doors.

AUTOMATIC CONTROL BOARDS.

Including automatic elevator controllers and similar devices, unless placed in fireproof locations and guarded (by screens or location) so that unauthorized persons cannot make contact with same, must be placed in metal enclosures.

For elevators located in fireproof rooms the room must be used only for the enclosure of the elevator machinery and the electrical control apparatus. The entire room, including floor, must be of fireproof construction. For the fireproofing of the floor concrete, tile or sheet metal must be used. Concrete must be at least three inches thick and when placed over wood floors all openings through such floors must have the exposed ends of boards covered by sheet metal. Sheet metal used as a floor covering must be not less than No. 14 U. S. S. gage. Ceilings if of wood may be covered by metal lath and plaster or by transite board not less than one-fourth inch thick. All doors to the room must be kept locked.

AUTO STARTERS, COMPENSATORS, ETC.

Where there are no exposed live parts no special protection is required. Where no-voltage or overload coils having exposed contacts are used such contacts must be enclosed.

RESISTANCE GRIDS.

All types of resistance grids must be protected against accidental contact either by location or by suitable ventilated enclosures. It is intended that the protective enclosure for grids shall be furnished by the manufacturers as a part of the device.

CIRCUIT BREAKERS.

Circuit breakers must be enclosed in metal cabinets and, if used in place of a switch, must be operable from the outside of the enclosure.

SPECIAL PANEL BOARDS

Such as dental boards and similar apparatus must have live parts protected.

ELECTRICAL HEATERS.

Electric heaters of all types must have no exposed live binding posts or contacts. This does not apply to the heating element.

RECEPTACLES NEAR FLOOR.

Receptacles located within thirty inches of the floor must be of the protected contact type. Receptacles of a type having Edison bases, and receptacles having bare contacts when the attachment plug is removed, will not be approved unless located more than thirty inches from the floor.

KNIFE SWITCHES.

Rule 24b, 2nd paragraph, reads as follows: "Knife switches, except on panel boards, switchboards, and distributing centers, must be of the safety enclosed type. Safety enclosed switches must be of an approved design and arranged to be operated from the outside of the enclosure. They shall be so marked as to indicate, without opening the enclosure, whether the switch is in the 'on' or 'off' position. They shall be so constructed and installed that the fuses, if fuses are used, will be dead when the switch is in the open position; and, except in the case of double-throw and alternating current motor starting switches, designed for 'starting' and 'running' positions, must be so constructed and installed that the blades of the switch will be dead when the switch is in the open position. If, in order to comply with the above, the incoming wires must be connected to certain terminals, such terminals must be marked 'line.'"

Note. "Panelboard" means a single panel or assembly of panels containing busses, fuses and in some cases switches, to control lights, fan motors, and similar devices of small individual as well as small aggregate capacity, placed in or against a wall or partition and accessible only from the front.

"Switchboard" means a large single panel, frame or assembly of panels on which are mounted (on the face or back or both) switches, fuses, busses, and usually instruments.

"Distributing center" means a single panel or assembly of panels containing busses, fuses and in some cases switches to control lights, motors and similar devices of large individual as well as large aggregate capacity, placed in or against a wall or partition and accessible only from the front.

In the case of apartment buildings with one circuit to an apartment a safety switch may be used for each apartment up to and including three switches and such switches will be accepted as service switches. Where there are more than three circuits a main line service switch of the safety type must be provided with a separate cabinet for the fuses.

This rule applies to all knife switches manually operated. Automatic switches may be enclosed in standard cabinets, with hinged doors.

EDISON PLUG CUTOUTS.

After January 1, 1922, Edison plug cutouts, except those used in connection with safety switches, must be of the dead front or safety type. Where such cutouts are used in apartment buildings the enclosing covers should be provided with a means of designating the location of the circuit.

STRIP FUSES.

Strip and link fuses will not be accepted. All fuses must be of the plug or cartridge type.

CABINETS.

Where devices are placed in metal cabinets, such cabinets must comply with the specifications on cut-out cabinets and boxes.

ENFORCEMENT OF RULES.

It is the intent of these rules to ultimately obtain from the manufacturer a class of apparatus which in its inherent design will provide the protection sought. In most cases this very desirable protection from both accident and fire can be obtained without any material increase in the cost of production. The department will, in obtaining a strict compliance with the provisions of the rule, extend every warranted concession, but it requests and expects the active co-operation of all concerned.

The rules will be enforced on all new installations and applied to all apparatus, except as noted below, whether the apparatus being installed is new or used. Where apparatus is moved from one location to another within the same building and for the same owner, or where a concern moves from one location to another, this rule shall not apply provided the apparatus has been previously approved by the department and is in good condition. On new installations, used apparatus, other than that exempted above, must be remodeled to comply, as far as practicable, with these rules before being again placed in use.

RULES AND INFORMATION PERTAINING TO ELECTRIC SERVICE, METERS AND WIRING OF COMMONWEALTH EDISON CO.

STANDARD FORMS OF SERVICE.

1. The Company's standard service for light and power is available in different forms, the kind of service available depending upon the locality and the amount of energy required, as follows:

2. Direct current, 3-wire, low tension Edison service at approximately 115-230 volts, available for light and power, only within the district boundaries shown on the map on page 4. On any installation coming with the shaded portions, or close to the boundary lines of this map, the customer must consult the Distribution Division of the Company, in order to ascertain the kind of service available, as these shaded territories are partially supplied with alternating current service and near the boundaries, direct and alternating current lines overlap in some places, and, in addition, the boundary lines are from time to time subject to change.

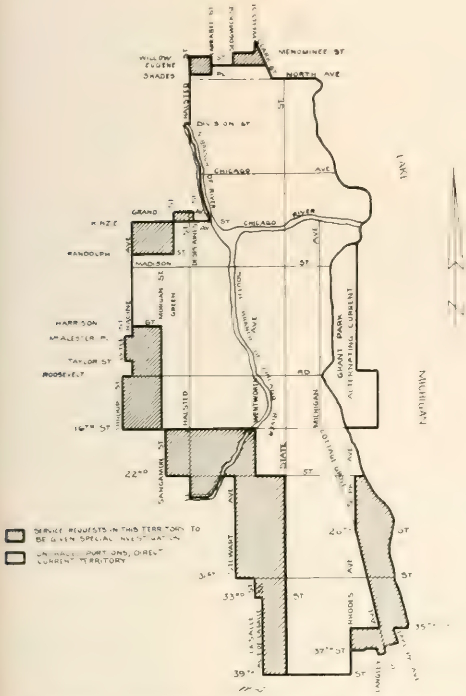
3. Alternating current, sixty cycle, single phase, 3-wire, low tension, transformed service, approximately 115-230 volts, is available for light and power (5 H. P. or less) outside of the boundaries of the direct current district, where the Company has single phase mains.

4. Where the Company has 3-phase mains, alternating current, sixty cycle, 3-phase, 3-wire, low tension transformed service, at approximately 230 volts, is available for power service for motors of 5 H. P. and larger, 3-phase service, at approximately 460 volts, will be furnished upon request for power installations having an aggregate rated motor capacity of 250 H. P. or more.

5. Alternating current, sixty cycle, 3-phase, 3-wire high tension service, untransformed, at approximately 12,000 volts, is available for consumers having a demand of 200 K.W. or more where the Company has available 12,000 volt transmission lines.

6. When service is desired at locations where the Company has no lines or where its lines are not suitable for the class of service desired, a line extension must be arranged for. In such cases the Company will, upon receipt of advice as to the class of service and amount of energy desired, have an estimate prepared of the cost of installing the necessary line extension. If

the estimated cost of the proposed line extnsion is in excess of the cost of a "free extension" as provided by the rules of the Illinois Commerce Commission, the excess cost of the extension must be deposited with the Company by the applicant or applicants.



7. **The Company will not be responsible for mistakes of any kind whatsoever which may result from information given orally on the character of its service or the location of its main, unless such information is confirmed in writing.**

SERVICE CONNECTIONS.

Overhead.

2. The Company will provide at its own expense, for any customer, one overhead service for light and, where required by these rules, one overhead service for power. The length of this service shall, in no case, exceed 115 feet. Where the length of the service exceeds the amount allowed by the Company, a pole must be provided for each 110 feet or fraction thereof, provided, however, that where, due to special conditions, such a span is impossible, single spans between poles may be increased to 125 feet in length. The pole must be of cedar, at least 25 feet in length, with a minimum diameter of 6 inches at the top and set in the ground at least 4½ feet. A square timber will not be approved as an intermediate support in place of a pole.

If, in order to give a better appearance, a steel pole is desired, this should be a two-section tubular steel pole, made up of two lengths of standard steel tubing, having nominal diameters of 4 in. and 5 in. The tubes should be joined by a swedge joint. This pole must be set in a concrete collar, at least 12 inches in diameter. At the top of the pole, drillings are to be made and a standard spool-type bracket must be mounted in the proper position. This bracket is to be 2 or 3 wire, depending on the character of the customer's installation.

The requirements in the above paragraphs refer to the installation of service connections which do not require a service in excess of the equivalent of 6 No. 6 B. & S. gauge wires. On installations requiring a service in excess of the above, the Distribution Division of the Company must be consulted for specifications covering the length of spans between poles and the size of poles.

4. Service outlets should never be more than thirty (30) feet nor less than ten (10) feet from the ground. For buildings of two or more stories in height, the outlet should be brought out at the ceiling of the second floor.

6. Risers used for the support of service wires are objectionable and should be used only in such cases where their use cannot be avoided. Every riser installation must conform to the rules of the Department of Gas and Electricity of Chicago.

8. Where a one story building is located on the alley lot line, the service, if brought out on the alley side of the building, will not clear the telephone wires if the pole is located on the same side of the alley as the building and will not give the required 18 ft. clearance over the alley (see paragraph 12 (c) if the pole is located in the opposite side of the alley. For this reason, the Department of Gas and Electricity of Chicago will permit a variation from the standard rule requiring services brought to the alley side of the building. On such one story buildings, the service should be brought out on that part of the building farthest from the alley, but in no case must the service outlet be more than 15 feet from the alley line. The service outlet should be placed on the same side of the building as the pole so that the service drop will extend away from the building and not over it. Where a pole is located directly back of a building of the above type, the service outlet, if located away from the alley side of the building, wil in some cases, eliminate the necessity of conduit being carried down the pole. The above modification of the rule of the Department of Gas and Electricity of Chicago only applies to one story buildings and will, in many cases, avoid the use of objectionable risers. In many cases, risers and the installing of wires down a pole may be avoided by connecting a rear building to the service drop installed for a front building. In such cases, the customer must install weatherproof wire between the rear building and the front building, but the final connection on the front building service will be made by the Company.

9. Service outlets must never be terminated within 1 ft. of a down spout which is located on a porch post or porch support.

10. Where a service outlet is terminated on a post supporting a porch, galvanized steel straps or braces must be fastened in such a manner that the post will be firmly held to the joist. Each strap must be at least 1 in. x 12 in. and ⅛ in. in thickness, and must be fastened to the post and joist by lag screws, 2 into the post and 2 into the joist, such lag screws to be ¼ in. x 2½ in. Two straps must be used, one on each side of the post.

11. Where wiring is being installed in buildings under construction which are to have a stucco or stone-coat finish, a substantial form of support for the service bracket must be provided, this support to consist of a 2 in. x 8 in. x 24 in. piece of timber projecting beyond the finish of the building and securely fastened to the studding of frame buildings or by hooks through the wall of brick or tile structures.

Instead of a timber, galvanized eye bolts, having a minimum diameter of ⅜ in., spaced 8 in. apart, may be used, the eye portion of the bolts to extend at least 2 in. beyond the surface of the building. When bolts are used for the support of a timber or the

service, they must extend through, and be anchored on the inside surface of the wall, to a substantial metal plate, not less than $\frac{3}{16}$ in. in thickness and having at least 4 square feet of bearing surface on the inside wall of the building.

The length of service mains to be brought outside of the service outlet and the method of fastening service wires to a building for No. 4/0 service connection and larger, and the method to be used for attachment of service connection for stucco or tile buildings.

12. Clearances.

(a) The service wires must, in no case, be within easy reach from porches, windows, or any other part of the building ordinarily accessible to the occupants.

(b) The service outlet must be so located that there will be at least 24 inches' clearance between it and any telephone or signal wires where attached to the building, and at least 36 inches' clearance must be provided between the service drops of both systems in the open span, in accordance with the rules of the Department of Gas and Electricity of Chicago.

(c) When the Company's pole line is on the opposite side of the street or alley from that of the building to which service is to be given, the service outlet for such a building must be of sufficient height to give at least an 18 ft. clearance between any point of the street or alley and the service drop.

Underground.

1. Where the space beneath the sidewalk is excavated, the service cables will be terminated at a point about 3 feet inside the curb wall. Service mains installed by the customer must be brought to the nearest service entrance, if there be one within 50 feet of his premises.

2. Where there is no service available, application should be made to the Contract Department of the Company to have service installed.

3. Where there is no sidewalk excavation and where there is a basement at the property line, the service cables will be terminated at a point about 3 feet inside the basement wall.

4. Where no basement is available at the property line, the service will be extended underground, at the customer's expense, from the property line to any point designated, but in no case will the service be terminated in any place which is likely to be used for coal storage.

5. In case the customer does not wish to bear the expense o fan underground service across his property, the underground service will be brought up on a pole at the lot line, provided the Companys underground mains are available in the rear of the customer's premises. The poles and the overhead service to the building will be installed at the customer's expense, unless the customer will permit the Company to use the pole to supply other customers.

6. On account of obstacles that are frequently met with in the street, it is impossible for the Company to determine in advance the exact location at which the service cables will enter the building. Because of this uncertainty, the service-cabinet should not be installed until after the Company has completed the laying of the service duct or pipe into the building.

7. Where the service cables are to supply not more than one set of building mains, the service-cabinet must be installed by the customer and located at the service stub in such a manner that the cables will be entirely enclosed. If this is not practicable, a junction-cabinet not less than 15 inches in length, 10 inches in width, and 6 inches in depth, must be installed by the customer over the underground pipe and enclosing the Company's service cables. This cabinet must be provided with a cover fastened in place with screws. Conduit must be installed by the customer to connect the junction-cabinet with the service-switch cabinet. Where the Company's service mains are larger than No. 6, the dimensions of the junction-cabinet must be obtained from the Inspection Bureau.

8. Where the service cables installed by the Company are terminated in a junction-cabinet enclosing the service cables, the customer's service conduit should be terminated at the junction-cabinet and locked into it. A sufficient length of wire must be left to permit the Company to make the connection to the service cables, inside the junction-cabinet.

9. The service-switch cabinet must be of ample size to permit the safe handling of the service cables, and the switch-panel arranged in such a manner as to permit the removal of the service cables for repairs or replacement without removing the panel. The service-switch must be fitted with lugs for connection to the service cables.

11. Where the size of the installation requires more than one set of underground cables into the customer's premises, the customer must install, at his own expense, a fuse-extension service-switch on each set of cables. A name-plate holder must also be mounted on the panel at each service switch, in order to facilitate ready identification, in case of an emergency on any of the several services.

Transformer vaults.

Where local conditions are such that transformers must be installed within a building on the customer's premises, the customer must provide at his own expense, a suitable vault constructed in accordance with the following rules and specifications:

I. GENERAL.

1. The vault or rooms should be located in an accessible part of the building, in space free from pipes or other facilities; it must be constructed of fire-proof materials and in accordance with the rules of the Electrical Code of the Department of Gas and Electricity and of the Building Code of the Building Department of the City of Chicago. Each vault so constructed is subject to the approval of the Company.

II. Transformer Vaults on Installations of 4,000 Volts or Less.

(a) General.

1. The transformer-room must be provided with a fireproof door of standard height, not less than 36 in. wide, and in case the transformer units are larger than 50 K. W., the door should be 48 in. wide. The door must be provided with a hasp suitable for a standard padlock, which will be provided by the Company. The location of the door must be such as to facilitate the moving of transformers in and out of the room. The entrance to the room must be unobstructed at all times.

2. In case the room is not on the ground floor, and unless there is adequate elevator service available, permanent facilities must be provided by which transformers weighing 5,000 lbs. each can readily be moved in and out of the transformer-room.

3. Suitable lighting should be provided within the vault, with a control switch inside the door.

(b) Floor Space.

1. The vault should be rectangular in form, if possible; the width should be not less than 8 feet in installations made up of transformers of less than 50 K.W. and not less than 12 feet in larger installations. The floor area must be not less than the amounts given in the following

Single Transformers:

Up to and including 50 K.W....... 64 sq. ft.
51 to 100 K.W. inclusive.......... 80 sq. ft.

Two Transformers:

Up to and including 50 K.W. each. 96 sq. ft.
51 to 150 K.W. each..............140 sq. ft.

Three or Four Transformers:

15 K.W. each.....................120 sq. ft.
50 K.W. each.....................200 sq. ft.
100 K.W. each....................250 sq. ft.

2. The space for transformer installations varies largely with local conditions and must be determined by consultation with the Company.

(c) Head Room.

1. The vault must have a clear height of at least 8 feet from floor to ceiling.

(d) Ventilation.

1. To protect transformers from overheating, air inlets and outlets of ample dimensions must be provided. The inlets must be placed not more than one foot from the floor of the room and must be arranged to take in air from outside of the building. There should be an inlet opposite each transformer in installations in which any transformer is larger than 50 K.W.

2. The air outlets must be not lower than 1 foot below the ceiling and should be terminated outside the building in a suitable ventilation outlet, extended to a sufficient height to insure an adequate draft.

3. Where openings are made directly to the outside air, they must be provided with suitable louvers to protect the openings from the entrance of rain and snow, and if accessible to persons, the openings must also be protected by suitable wire screens.

4. The inlets and outlets must each be of not less than the following areas:

Up to and including 37½ K.W.......1 sq. ft.

For larger installations the area must be not less than 3 sq. in. per K.W. of transformer capacity. All plans covering ventilation must be submitted to the Company for approval.

(e) Wiring.

1. The meter and the secondary service-switch must be placed outside the transformer-room, in an approved location. The connections from the secondary service-switch to the vault must be provided by the customer.

2. The work of installing all primary and secondary wiring and accessories, cables, and transformers within the vault is to be done by the customer at his own expense in accordance with plans furnished by the Company. The amount paid by the customer shall be the estimated cost of making the transformer vault installation, less the estimated cost of making an equivalent transformer installation on poles. The Company will furnish and retain ownership of the line and meter transformers and primary fuses. The Company will deliver the transformers and the primary fuses to the curb line of the building, but the customer is responsible for damage to all such apparatus after delivery. All other apparatus and material is to be furnished by the customer.

III. Transformer Vaults on Installations in Excess of 4,000 Volts.

(a) General.

1. These specifications refer to installations made within vaults or structures on customers' premises and connected directly to the Company's transmission system. They are subject to such variation in details by the Company as local conditions may make necessary, and in case of any such variation, the specifications will be supplemented by sketches showing the requirements of the Company.

2. The installation is to be placed in two adjacent fire-proof rooms, provided by the customer, and must follow the specifications herein set forth, with such supplementary specifications as the Company may in special cases provide. One of these rooms, containing the line-switches, bus-bars, and auxiliary equipment, will be known as the "Line-Room"; the other, containing the transformers, and subsidiary oil switches, will be known as the "Transformer-Room.

3. These rooms must at all times be readily accessible for inspection and repairs, and where they are located above the ground floor, a permanent overhead supporting structure, capable of handling a load of approximately 10,000 pounds, must be provided for hoisting the transformers to the required level. Unless access to such rooms is from a floor at the same level, a platform at this level must be provided, together with a stairway from the floor below or from the ground, so arranged as to give convenient access to the rooms at all times.

(b) Meter Panel.

1. The customer will provide a suitable panel or space on a switchboard outside of the Line and Transformer Rooms for the installation of the Company's meters and will also provide thereon the wiring, test links, and terminals required for such meters.

(c) Ownership.

1. All building work in connection with the Line and Transformer-Rooms must be installed by and at the expense of the customer, and shall remain his property.

2. In case the customer has contracted for untransformed energy the equipment in both rooms must be installed at the expense of the customer.

3. In case the customer has contracted for low tension energy, the equipment in the Line-Room will be provided by and remain the property of the Company. All equipment in the Transformer-Room must be provided are installed at the expense of the customer, except that the line and meter transformers will be provided by and at the expense of the Company.

4. Under either of the above mentioned forms of contract the relay equipment provided in the Line-Room, in connection with a loop service, shall be under the exclusive control of the Company and may be changed from time to time at the expense of the Company, if deemed by the Company necessary for the satisfactory operation of the lines.

(d) Engineering Service.

1. Engineering service which includes, before the installation is put in service, all work of design, supervision, inspection, and testing of the high voltage portion of the installation and the metering equipment, will be performed by the Company in all cases.

2. In case the customer has contracted for untransformed energy, this service will be performed by the Company at the expense of the customer.

3. In case the customer has contracted for low tension energy, this service will be performed at the expense of and by the Company.

(e) Lighting.

1. Approximately eight (8) lighting outlets will be required for each of these rooms.

LINE-ROOM.

(f) Structure.

1. The Line-Room must have a minimum floor area of approximately 204 square feet (preferably 12 x 17 feet) with a minimum head room of 12 feet. A fireproof door must be provided to give access to this room, preferably from the Transformer-Room. This door must have a threshold six inches high and be equipped with a standard cylinder lock furnished by the Company. An

opening suitably located and equipped with adjustable louvers must be provided for ventilation of this room. Only the employes of the Company shall have access to this room.

2. The division wall between the two rooms shall be a 9-in. brick wall, with openings for oil-switch control handles and mechanism, and also an opening for ventilation between the two rooms, in addition to the openings specified above. The sizes and locations of these openings will be designated on sketches furnished by the Company.

(g) Equipment in the Line-Room.

1. The equipment in the Line Room will consist of high tension switches, disconnects, and other necessary auxiliaries to protect the customer's service.

TRANSFORMER ROOM.

(h) Structure.

1. The Transformer-Room must have a floor space in proportion to the transformer capacity to be installed (the exact size in each case to be specified by the Company) and the head-room must be at least 12 feet. An exterior fireproof door must be provided to this room approximately 5 feet wide by 9 feet or more high, to give ready access for the installation of the electrical apparatus. This door is to have a six-inch threshold and is to be equipped with a standard cylinder lock furnished by the Company.

2. The floor of the Transformer-Room must be provided with an adequate system of floor drainage to take care of a possible overflow of oil or water.

(i) Equipment in Transformer-Room.

1. The Transformer Room equipment shall consist of the necessary power and lighting transformers, primary oil switches complete with disconnective switches, relays, high voltage bus work properly insulated, framing and connections to the Line Room terminals, and connections to the primary terminals of the transformers; also, on the secondary side of the transformers all necessary copper work and supporting frame work between the secondary terminals of the transformer and the metering-current-transformers, which in the case of a low tension energy contract, shall be located as near as possible to the main transformer terminals. (In the case of a contract for untransformed energy, the metering-transformers will be located in the Line Room.)

(j) Ventilation.

1. The customer must provide for air supply and exhaust of sufficient capacity to insure proper cooling of the transformers. Where the temperature of the air surrounding the vault is sufficiently low, properly located louvers of adequate size in side walls, in addition to roof ventilators, or their equivalent in exhaust duct to outside air, may be sufficient. Where the location of the vault renders this method of cooling inadequate, forced ventilation must be provided by the customer and should be arranged so that the supply will be adequate at all times. The Company will advise the customer regarding the details of the ventilating provisions in each case.

WIRING.

Meter Connections.

1. Wiring must be so arranged that a separate meter may be installed for each class of service supplied under the Company's schedule of rates, as follows:

I Rate A.

1. Available for any customer using the Company's standard service for lighting purposes or for both lighting and power purposes, provided that electricity will not be furnished hereunder for welding machines, wireless telegraph apparatus, or other power apparatus in which the use of electricity is intermittent or subject to violent fluctuation and the operation of which may interfere with lighting service.

2. Where the rated capacity of the customer's installation is 1½ K. W. or less, the maximum demand is determined in accordance with a table set forth in the rate schedule, which provides for different values of demand for commercial and for residence lighting. The arrangement of meter connections of such installations must be in accordance with the following regulations:

(a) The wiring of residence and commercial installations must be arranged for separate watt-hour meters.

(b) The lighting of halls, entrances, and basements of apartment buildings will be considered as commercial lighting provided that where the hall, entrance, and basement lighting installation has a rated capacity of 200 watts or less and where the owner occupies one of the apartments in the building as his place of residence, this lighting load may be connected to the meter for his apartment, and, if so connected, such an installation will be considered as residence lighting during the period of such occupancy.

(c) Where apartments and stores or shops are in the same building the apartment lighting will be considered as residence lighting and the store or shop lighting will be considered as commercial lighting, and the wiring should accordingly be arranged for separate meters, provided, however, that if the customer desires, both installations may be combined on one meter, and the combined installation will be considered as commercial lighting. (For combined installations exceeding 1½ K. W. see 3-(b) below.)

(d) Where a portion of a store or shop is used as living quarters, and the wiring is arranged for a single meter for both the store or shop and the living quarters, the installation will be considered as commercial lighting.

3. (a) Where the rated capacity of a customer's installation is more than 1½ K. W., the wiring must be arranged for the installation of demand meters.

(b) In case the residence and commercial lighting installations of a customer have an aggregate rated capacity of over 1½ K. W. and are in the same building, both installations should be arranged for connection to one watt-hour meter, with demand-meters.

II Rate B.

1. Power service is supplied under this rate, and is defined as "electric service used for other purposes than lighting." Service for photographic printing, bath cabinets, and other kinds of equipment which are not used for general illumination, will be considered as power service and may be served under Rate B, if desired.

2. In the case of direct current installations, having rated capacity of more than 1½ K. W., the maximum demand is measured, and provisions must be made for setting a demand-meter.

3. In the case of alternating current installations having a rated capacity of 10 H. P. or more, provisions must likewise be made for setting a demand-meter.

III Rate C.

1. The lighting and power service for large users may be combined under Rate C. However, on the alternating current system a separate service and meter may, at the option of the Company, be provided for the lighting service, and in such cases the wiring must be arranged accordingly for meters.

Residence and Apartment Loads.

1. Every residence and apartment lighting installation which does not exceed 3,000 watts, or 48 sockets must have a 2-wire service main and 2-wire meter loops, as such an installation will be connected to the Company's system by two service wires at 115

volts. Where the installation exceeds 3,000 watts, or 48 sockets, it must be wired for 3-wire service and a 3-wire meter. All wall receptacles other than brackets will be figured at not less than 100 watts each.

Commercial Loads.

1. Every business lighting intallation of over 1500 watts must have a 3-wire service main and 3-wire meter loops except where the installation consists of 1-2000 watt circuit only. This must obviously be connected 2-wire. If the installation is 1500 watts or less, it must be wired with a 2-wire service main and 2-wire meter loops. Motors operating on 115 volts and heating appliances on the lighting service will not be considered in determining 2-wire and 3-wire installations where the rated capacity of such equipment does not exceed 25% of the lighting load.

Business and Residence Loads in Same Building.

1. On installations where there are stores and apartments in the same building, the rule governing the service and meter installation is as follows:

Where the total connected wattage is 3000 watts or less, add to the total connected wattage of the stores ¼ of the connected wattage of the apartments, and, if the total is 1500 watts or less, the service mains and meter loops must be 2-wire. If this wattage, however, is in excess of 1500 watts, service mains must be 3-wire but the meter loops will be governed according to the rules above on residence and commercial lighting. Where watts, the service must be 3-wire.
the total connected load is in excess of 3000

Motor Loads.

1. In direct current territory where the aggregate power load does not exceed 10 H. P., the motor should usually be wired to connect to the lighting meter.

2. In alternating current territory, the fluctuation in voltage caused by the starting currents prevents the connecting of motors larger than ½ H. P. of the split-phase type, or larger than 1 H. P. of the repulsion-induction type, to the lighting service, except is special cases. Two or more motors, not larger than the above mentioned sizes, may be connected to the lighting service where the aggrgate does not exceed 2 H. P.

Miscellaneous Loads.

1. Single D. C. stereopticons, outlets for battery charging, and other devices which are operated most economically at 115 volts will be approved for this voltage. Where there is an installation of more than one such device in the same premises, they must, if the total wattage of the installation exceeds 1500, be connected to a 3-wire main and be balanced as nearly as possible.

2. Every alternating current vehicle-charging mercury arc rectifier in a private garage must be connected to the customer's lighting service, provided such a service is already installed. If the existing lighting service is a 2-wire service, a 3-wire outlet must be provided.

3. If, at the time the rectifier is installed, there be no existing lighting installation in the premises, and later the customer desires to put in a lighting installation, such an installation must be wired for a 3-wire service.

4. All rectifiers requiring an input of more than 2 K. W. must be operated at 230 volts.

5. In theaters, all alternating current or single phase motors, and such motion picture and spot arcs as are not supplied through 3 phase converting apparatus, must be connected to the same meter.

6. Alternating current arcs requiring more than 2 K. W. must be operated at 230 volts.

7. Where transformers are used in connection with motion pictures arcs or spot arcs they must be operated at 230 volts.

8. In the case of welding machines, X-ray machines, hoists, elevator motors, furnaces, and other installations of similar character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable wiring or equipment to limit, in a reasonable degree, such intermittence or fluctuation, where in the Company's judgment, such apparatus is necessary to prevent undue interference with the Company's service.

Auto Transformers.

1. Where the lighting is connected to the power service by the use of an auto-transformer, as under Rate "C," such transformer must be provided at the expense of the customer. The auto-transformer must be connected between the two mains having the least difference of potential to the earth. Where the load is 20 K. W. or less, the capacity if the auto-transformer should be not less than 25% of the connected load in watts.

Voltage Regulation.

1. The wiring installed in the customer's premises should be of such capacity that the entire connected load can be carried with a loss in voltage of not more than 2% between the service entrance and the most remote lamp on the premises.

Switchboards.

1. Specifications and blue prints for service and meter-switchboard installations must be submitted to the Distribution Division of the Company for approval before construction of the switchboard is begun.

2. Fuses must be so arranged that they will be readily accessible for the purpose of replacement, and to this end, it is recommended that no more than three rows of switches be placed on a switchboard.

3. To prevent overheating of switches, fuses, and cables, it is recommended that all the lugs have a conductivity of not less than 60% of that pure copper and that their cross-sectional area be such that they will not be required to carry continuously more than 600 amperes per square inch. They should have a bolting contact surface of not less than 1 square inch for each 150 amperes of current.

4. The general arrangement of the connections on the back of the board must be such as to render it possible to make repairs or alterations with a reasonable degree of facility and safety while the board is in service.

5. The bus bars must be rigidly supported and the arrangement of the feeder cables between the terminal of the conduit system and the back of the switchboard must be made in a systematic and orderly manner and the cables must be segregated as far as possible, with a view to minimizing the possibility of serious interruption to the service.

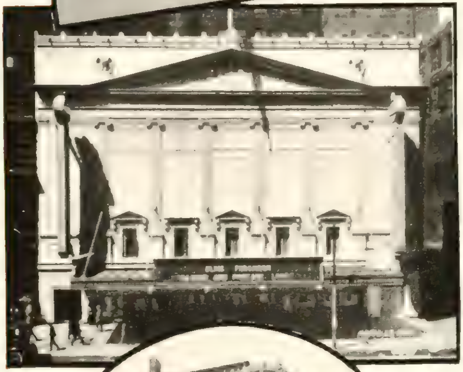
6. Where the Company's service cables are extended inside of the customer's premises to the switchboard and where such cables are not protected by duct or conduit they must be properly roped and cemented at the expense of the customer.

Cutouts.

1. Fuse-blocks and service-switches must be equipped with fuses of approved type and capacity at the time of their installation.

2. The neutral wire of a 3-wire service-switch or cutout block for branch mains, except for 3-phase, must not be fused.

3. The neutral wire must be connected to the center blade of all 3-pole switches except for 3-phase. On 3-phase installations the two phases having the least difference of potential to earth must be connected to the two outer blades of the service-switch.



4. Switches and fuse blocks must not be installed above or in close proximity to laundry tubs, sinks, or other plumbing fixtures.

Grounding Conduit on Neutral Service Wire.

1. The use of the neutral service wire for grounding conduit is not permitted. The conduit should preferably be grounded to the cold water piping system, in accordance with the rules of the Department of Gas & Electricity of Chicago.

2. The customer must ground the neutral wire of his installation separately from the ground provided for the conduit system. This neutral ground must be installed according to the rules of the Department of Gas and Electricity of the City of Chicago. 3-phase and 2-wire, 230 volt single phase systems having no wires within the building at ground potential, are not to be grounded at the building service.

APPARATUS.

Welders and Furnaces.

Call Commonwealth Edison Co., Randolph 1280 for information.

X-Ray Machines.

Call Commonwealth Edison Co., Randolph 1280 for information.

Electric Ranges, Ovens, and Heating Appliances.

1. Electric ranges and other heating appliances in which the aggregate rating of the heating units is not more than 2 K.W., will be connected for 115 volt, 2-wire service. Where the aggregate rating of the heating units exceeds 2 K.W., they must be so arranged that they may be connected to a 3-wire, 115-230 volt circuit, and the units must be balanced as nearly as possible on each side of the circuit.

2. Electric ranges and heating appliances for family use must be connected to the lighting service, if one is installed.

3. Electric ranges, ovens, and heating appliances of 10 K.W. and less, installed in places of business, must be connected to the lighting service. Where the K.W. rating is in excess of 10 K.W., or where the heating load is intermittent, inquiry should be made of the Distribution Division of the Company, as to how the particular installation should be connected.

Nameplates.

1. All electrical equipment such as motors, welders, furnaces, X-Ray and radio apparatus, heating utensils, and the like, must be provided with nameplates showing the rating of the apparatus. This rating must be in kilowatts, horsepower, kilo-volt amperes, or amperes and volts, cycles, phase; according to the nature of the apparatus. The character of current required for the operation of such apparatus must also be designated.

MOTORS.

General.

1. The following motor regulations are necessary for the purpose of securing uniform service for all customers, as the successful operation of motors on the same circuits with lighting apparatus requires that the normal voltage of the supply circuit be closely maintained.

2. In the case of hoist or elevator motors, welding machines, furnaces, and other installations of similar character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable wiring or equipment to limit, in a reasonable degree, such intermittence or fluctuation, where in the Company's judgment, such wiring or equipment is necessary to prevent undue interference with the Company's service.

3. Stationary vacuum-cleaner motors of over 1 H.P. which are used in apartment buildings, must be so wired that separate meters for them can be installed. This rule rule prohibits the connection of these motors to the individual tenants' meters.

Direct Current.

1. Direct current motors of 1½ H.P. and smaller may be operated on either 115 or 230 volts. Motors larger than 1½ H.P. must be operated on 230 volts.

2. A starting resistance is recommended in connection with all direct current motors, but motors not larger than ½ H.P. of the shunt type, ¾ H.P. compound, and 2 H.P. series wound, not requiring a starting current in excess of the values given in the starting current tables, may be installed without starting resistance.

3. Direct current motors aggregating 10 H.P. or less must usually be wired so that they may be connected to the lighting meter.

Alternating Current.

1. All alternating current motors which start frequently, such as those operating coffee mills, meat grinders, shoe repairing machines, electric pianos, pumps, carbonators, etc., must be wound for and connected so as to operate on the Company's 230 volt service, except that the repulsion induction type of motor, of less than ¾ H.P., may be operated on 115 volt service.

2. Split-phase motors of ¼ H.P. and smaller, which do not start frequently and any repulsion-induction motor of ½ H.P. and smaller, may be operated on 115 volts when the starting current does not exceed 15 amperes, provided the lighting service is not interfered with by the operation of the motor.

3. The wiring must be so arranged that all motors of the repulsion-induction type of 1 H.P. and less, or of the split-phase type of ½ H.P. and less, may be connected to the lighting service and meter. Either type of motor above these sizes must be wired for separate service and meter. When the aggregate rating of two or more motors of the types mentioned does not exceed 2 H.P., they must be wired to the lighting service. This will require 3-wire service and 3-wire meter loops, where 230 volt motors are installed. Where larger motors are installed, or where the aggregate is more than 2 H.P., the wiring must be so arranged that all motors can be connected to a separate service and meter.

4. Special permission may, in some cases, be obtained from the Distribution Division of the Company to connect the lighting service, motors larger than 1 H.P. of the repulsion-induction type, or ¾ H. P. or larger of the split-phase type, where these motors operate stationary vacuum-cleaners and house-pumps. The granting of this special permission will depend on the size of the building, the capacity of the Company's lines, and the building mains.

I. Single Phase System.

1. When single phase motors or other apparatus are connected to one phase of a 3-phase installation, they must be connected between the two wires having the least difference of potential to the earth. The Distribution Division of the Company must be notified when any single phase motor is to be connected on a 3-phase installation.

2. No motors larger than 5 H.P. will be supplied on the single phase system except by special permission given in each case by the Distribution Division of the Company.

II. Three-Phase System.

1. Motors of 5 H.P. or more are supplied from the 3-phase system in a large part of the alternating current territory, but inquiry should be made of the Contract Department of the Company as to the prox-

imity of 3-phase lines to any particular location at which such power may be desired.

2. 3-phase service will not be provided for installations aggregating less than 5 H.P. unless the customer deposits with the Company a sum equivalent to the excess cost to the Company of installing a 3-phase service and meter, above the cost of installing a 3-phase service and meter, plus the excess cost of installing a 3-phase line extension over a single phase extension, provided such an extension is required. In case the customer's power installation shall subsequently be increased to a total rated capacity of 5 H.P. or more, the Company will return the amount of the deposit.

3. Reverse-phase relays or series-wired hatch-limit switches must be installed on all 3-phase elevator, crane, and similar installations, as required by the Department of Gas and Electricity of Chicago.

III. Large Sizes.

1. Motors having a rated capacity of 50 H.P. and larger, must be, whenever practicable, of the synchronous type. If synchronous motors are impracticable, motors having a rated capacity of 50 H. P. and larger, must be of the wound-rotor or slip-ring type.

2. Motors having a rated capacity of 100 H.P. or larger, must be of the synchronous type. This rule will be waived if the power factor of the installation, upon test at full load, is not less than 85%.

IV Starting Apparatus.

1. All motors of 7½ H.P. rating, and above, must be equipped with starting apparatus.

2. Every starting device must be equipped with a no-voltage release which will cause it to be thrown to the starting position, or the circuit opened entirely, in case of an interruption to the power supply. Motors which are equipped with an internal resistance, making it unnecessary to install a compensator in order to reduce the starting current, must be equipped with a no-voltage release device unless the internal resistance is automatically cut in by the reduction of the motor speed when the power circuit is opened. For motors of large capacity which are difficult to start, the no-voltage release must have a time element relay, which will prevent the opening of the circuit in the event of momentary voltage fluctuation.

3. In the case of the star-delta starting method, the starting-switch must be so arranged that it cannot be thrown into the running position before being thrown into the starting position. Motors started by this method must be equipped with a no-voltage release device.

4. Special permission will be given for the connection of special high-resistance-rotor elevator motors not larger than 10 H.P. without the use of a starting device, provided, the starting current does not exceed the values given in the table for starting currents.

Starting Current.

1. As voltage regulation is affected by the amount of current taken from the line, a motor exceeding the maximum allowable starting current will not be connected to the lines of this Company, since its operation would prevent satisfactory service to other customers using the lighting service of the Company. The instantaneous current (determined by test or based on the value guaranteed by the manufacturers) drawn from the lines by any motor (with the starting device, if any required, in the starting position) must not exceed the value for the rated horsepower of such motor, as obtained from the following tables:

2. Single Phase—60 Cycle.

Horsepower	Volts	Starting amperes
½ H.P. and below	220	15
¾ H.P. and 1 H.P.	220	20

		Starting amperes per horsepower
1¼ H.P. up to and including 5 H.P.	220	15
6 H.P. and above	220	11

Three-Phase—60-Cycle.

Horsepower		Starting amperes per phase per horsepower
5 H.P. and below	220	13
6 H.P. up to and including 30 P.H.	220	9
31 H.P. and above	220	6

Current values in the above tables are those indicated by a suitable well-damped ammeter in the motor circuit on the line side of the compensator, and are 75% of the permissible locked-rotor values.

3. Direct Current.

Horsepower	Volts	Starting amperes per horse-power
3 H.P. and below	220	12
Above 3 H.P.	220	9

Current values in the above tables are those indicated by a suitable well damped ammeter on the line side of the starting resistance.

Fire Pumps.

1. Fire-pump motor installations must be made in accordance with the rules of the authorities having jurisdiction over such installations.

2. Meters for fire-pump installations shall be of the shunt type for direct current system and of the current transformer type for alternating current systems. A meter-cabinet of shape and dimensions as shown on the drawings ,on pages 60 and 61, must be furnished and installed by the electrical contractor. This cabinet must be provided with a door which can be fastened with a padlock, which will be furnished by the Company. The cabinet may be located at any point in the service run, provided it is readily accessible and not subject to moisture or vibration. Conduits carrying service mains must enter the cabinet in a standard manner, and the cables must be long enough to connect with lugs on the shunts or current-transformers. The lugs for the shunts or current-transformers will be furnished by the Company, but are to be installed by the customer at his expense. A 1 in. slate base for the mounting of the meter and other equipment, standard cartridge-fuse cutout-block of capacity shown, must be furnished and installed by the customer at his expense.

3. Where a separate service is required for a fire pump, the customer must pay the cost of the service installation. Where a meter has been furnished by the Company for regular power load, the usual rental will be charged for the separate fire-pump meter, as provided under "Meters," sub-title "General," paragraph 2, page 43. In case a printing meter is required the usual rental will be charged and the customer must pay for installation of such meter.

METERS.

General.

1. The Company will install one meter or one unified set of meters for one class of service.

2. A monthly rental charge for each additional watt hour or demand meter is made by the Company when, at the request of the customer, and for his convenience, there is

an installation of more than one meter on his premises for one class of service. This rental is based on the size of the meter installed.

3. The Company must be consulted whenever it is necessary to know in advance the type and size of meter which a given installation will require. Information relative to the type of watthour meters and maximum demand meters to be used on large installations must be obtained from the Distribution Division of the Company before wiring is completed.

Location.

1. All meters must be installed in a suitable place as near as practicable to the point at which the service enters the building. The wires should be enclosed in a continuous metal conduit, containing no junction or outlet-boxes between the service entrance and the meter. The installation of load-wires in the same conduit is not allowable. In office buildings, special meter-closets of ample size must be provided on each floor; in apartment buildings, all meters should preferably be installed in the basement, and the circuit to each apartment should be carefully labeled. In residences, meters should be installed in the basement, or in a rear hall, and not in the attic.

2. The requirements of a "suitable place" for a meter are the following:

(a) Meters must be accessible to the Company's employes at all reasonable times, and must be so located that they may be easily read, inspected, and tested, with a minimum of annoyance to the tenants. Small capacity meters must be so installed that the top of the meter fitting is not more than six feet from the floor, and on meters of a capacity of 100 amperes and above, this distance must be not more than 4 feet 6 inches. Meters must not be placed in bedrooms, closets, bath or toilet rooms, or in any room commonly kept locked, in too close proximity to coal bins, in elevator or ventilator shafts, near stoves, radiators, sinks, wash tubs, steam piping, heaters, or boilers. Meters must be at least 3 feet from any gas meters or gas piping unless a suitable barrier is provided.

(b) The location selected must be free from moisture. A watthour meter must never be placed under a water pipe from which water may drip, as a result of condensation. When a damp location is unavoidable, a moisture proof cabinet must be provided by the customer to contain the meter.

(c) The location must be free from vibration. Where traffic is heavy, or cars are passing, meters should be placed upon a wall at the building-line, rather than upon the front curb wall, and must never be placed under the sidewalk, except by special permission from the Distribution Division of the Company. They must not be placed on any insecure partition, over a doorway, or in a stairway.

(d) Meters must be located, if possible, so that they will not be exposed to mechanical injury. If this is unavoidable, a suitable cabinet must be provided by the customer to contain the meter, so as to protect it thoroughly from possible damage.

(e) The meter location must be as free as possible from magnetic disturbance. Meters must not be installed in close proximity to motors or generators or cables carrying heavy loads. Cabinets for direct current meters must be of asbestos board or non-magnetic metal.

3. When meters are to be installed for construction work, substantial cabinets of weather-proof construction must be provided by the customer to protect them from injury. The final connections between the customer's wiring and the Company's mains will, in every instance, be made by the Company. When it is possible, a meter location which can be used throughout the construction period should be selected at the outset.

4. Meter-cabinets must be of ample size to permit the safe handling of wires for connecting, disconnecting, or testing the meters. If a metal cabinet is used, the inside must be lined with suitable insulating material.

5. Meter-fittings for private garages must be so located that the meter can be read without the necessity of entering the garage except in cases where the garage is open or where a key can be obtained on the premises at all reasonable hours. A meter can be read witout entering the garage if installed so that it faces a window made in the wall of the garage. This window must be covered by glass so as to render the meter visible and in addition, protect it from damage and theft. When this method is used, the meter board must be hinged or otherwise installed so that the meter will be accessible for testing. Subject to the approval of the Company, other methods of installing the meter ss that it may be read without entering the garage will be considered.

Meter Loops.

1. Meter loop fittings must be provided on all installation where the meter installed is of smaller capacity than 200 amperes. The size of a meter is determined by the amount of current required on any given installation and not by the connected load. Therefore, it is necessary to take this fact into consideration when determining whether or not a meter fitting is necessary.

2. When meter loops are provided for meters of smaller capacity than 200 amperes an approved meter safety cabinet and meter connection-block must be installed. Approved safety cabinets are of a type which permit the mounting the Company's watt hour meter in combination with the cabinet so that by means of suitable adapters or end walls, all connecting wires are completely enclosed. Approved connection-blocks are of a type which permits disconnecting the meter for exchange or test without interruption to the customer's service. All necessary adapters or shutters will be furnished by the Company and installed with the watt hour meter.

3. Safety-cabinets and meter connection-blocks, which can be used interchangeably to a large extent, have been standardized and they are now obtainable from a number of different manufactures. They comprise in the 30-ampere size.

(a) A combination fused service-switch and connection-block for single installations.

(b) A fused connection-block and cabinet for bank or single installation with separate service-switch.

Connection-blocks for installations of over 30 amperes are, as a rule, not available in combination with fuse blocks or service-switches.

5. For the mutual protection of customer and Company, all service and meter-cabinets will be kept sealed in order to accomplish the full safety features of the equipment. Consequently, when they are of a fused type, circuit fuses must also be provided on the load side of the meter which will be accessible to the customer. The fuses in the meter cabinet should be of a size determined by the capacity of the connection-block and should in all cases be heavier than the customer's fuses.

6. A card-holder must be provided on every meter loop fitting. The contractor must insert in this holder a card showing the complete address and the location in the building of the premises connected to the meter fitting.

7. Meter-loops or meter-fittings must be so arranged that the meters can be placed at least 6 inches away from iron cabinets and cut-out boxes, so as to permit the safe handling of wires during tests.

ATTALITE

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A Better Light for Less Money!

Being scientifically designed, Attalites are admirably suited for installation in stores, display rooms, office buildings and certain kinds of manufacturing plants.

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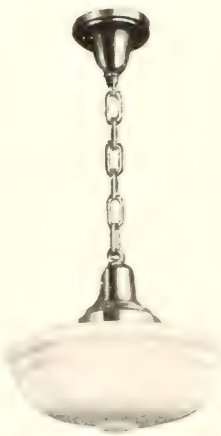


PENDANT TYPE ATTALITE

LITERATURE AND PRICES ON REQUEST

CEILING TYPE ATTALITE

Central Electric Company

FOUNDED 1887

The House of Service

316-326 South Wells Street
CHICAGO

8. The distance between centers of meters of 50 amperes or less must not be less than 10 inches for A. C. and 15 inches for D. C. meters. Meters of a capacity in excess of 50 amperes must have a distance between cnters of not less than 24 inches, and the leads of one meter must not run within 12 inches of another meter.

9. Service and house leads for type C. S. 2 and type C. S. 3 Thompson direct current meters, which are the types usually installed in size of 200 amperes and larger, must be carried in a metal trough to a point directly beneath the meter, and must be brought outside the trough through bushings spaced far enough apart so that the loops may be run in a direct vertical line to the meter terminals. They must be so anchored that the weight of the cables will not rest on the meter terminals, as shown in diagram on page 29. The length of the meter loop required outside the trough is determined by the type of meters to be installed.

10. When external resistances, current or potential transformers are used in connection with meters, they must be located where they are accessible for inspection and can be removed without danger of making a short circuit.

11. Contact-making clocks for operating type P demand meters must not be installed within a loop formed by the cable leads nor close to conductors carrying heavy currents, as the magnetic field may affect their accuracy, nor should they be installed in any place subject to extreme changes in temperatures.

Meter Fuse Protection.

1. All meters must be protected by suitable fuses of approved capacity. Meters must never be placed between the service and the service-switch.

Meter Board.

1. A suitable meter-board of pine or other soft wood, not less than ⅞ in. in thickness, or transite board (or equivalent), not less than ½ in. in thickness, must be provided by the customer and fastened rigidly to the wall or other support. If transite board or equivalent is used it must be so mounted that it fill be accessible from th back of the board in order to permit a nut to be fastened to the machine bolt which is used for support of the meter. Where the meter-board is mounted on metal lath or other metal structure, all supporting screws or bolts must be countersunk. The dimensions of meter-boards and the location on them of meter-fittings of less than 200 amperes capacity, may be secured from the Commonwealth Edison Co.

Types and Dimensions.

1. Standard front-connected meters are provided for all alternating current installations. Current-transformers are used in connection with alternating current meters of a capacity in excess of 150 amperes. Current and potential transformers are required on all motor installations on primary lines

2. Standard front-connected type of direct current meters are used up to a capacity of 150 amperes, 230 volts, 3-wire and 300 amperes, 230 volts, 2-wire. Meters of larger capacity, of either the front-connected or the back-connected switchboard type will be furnished.

Switchboard Meters.

1. Switchboard meters and their necessary equipment will be furnished by the Company for large installations if the customer makes arrangements with the Company in advance and provides for the necessary drilling and connections for both meters and their equipment. Demand meters, printometers, contact-making clocks, and relay switches are part of the meter equipment. Proper templates and wiring diagrams will be furnished by the Company.

2. Test-links must be installed with all switchboard meters. For 2-wire meters, two test-links are required, one in the service lead to the meter, and one in the load lead from the meter. For the 3-wire meters, four test-links are required, one in each of the service leads to the meter, and one in each of the load leads from the meter. Test-links should be located on the front of the switchboard. The meter test-links approved may be secured from the Commonwealth Edison Co. The test-terminals, studs, and links of an approved type only will be accepted by the Company and must be furnished and installed by the customer.

3. In all cases test-links must be readily accessible and must be placed at a distance of not less than 2 inches from any switches, bus-bars, switchboard-frame, or frame bolts, so as to eliminate, as far as possible, danger from short circuits in making connections for tests.

4. When current-transformers or other metering equipment are mounted at the rear of the switchboard, there must be left a clear space of not less than 30 inches between such current carrying parts and the wall, to permit free access to this equipment.

5. The fuses provided for protection of printometer and other demand meters must be mounted so as to be accessible without the danger of the Company's representatives coming in contact with live parts of the switchboard while replacing these fuses.

6. Various details, such as the method of metering, the type and capacity of watt hour meters and maximum demand meters, and the size of test-links, will be determined by the Company for each switchboard installation. These details must be taken up with the Distribution Division of the Company by the customer or his representative before the board is designed and sufficiently in advance of its construction to give the Company sufficient time to obtain the special equipment. Blue-prints or sketches showing the proposed location and connections of meters and equipment on switchboards must also be submitted to the Distribution Division for approval before the switchboard is constructed.

GAS FITTERS' RULES

Of the Peoples Gas, Light and Coke Company

OFFICE BUILDINGS, DWELLING HOUSES AND FLATS
MANUFACTURED GAS FOR LIGHT

INDEX TO RULES

Preface

The following rules governing the piping of buildings for distribution of gas for light, fuel, heat and power, have been adopted by The Peoples Gas Light and Coke Company.

This Company reserves the right, at its discretion, to alter, amend or revoke these rules as may hereafter appear for the best interests of the Company and its patrons.

All gas-fitters' rules previously issued are hereby revoked.

It is the purpose of the Company to enforce these rules, and no certificates of inspection will be issued unless they are complied with.

General Instructions.

1. Inspection of piping. Piping must be inspected by the Gas Company after it is completed and before the interior of the building is lathed or covered. Twenty-four hours' notice will be required for inspection. Gas fitters must have the work completed and the piping tight before they notify the Gas Company to make inspection.

2. Testing. Before fixtures are installed, the piping must stand a pressure of 6 inches on a column of mercury without showing any drop in the column for a period of ten minutes.

After fixtures are installed, piping must stand a pressure of one inch on a column of mercury without showing any drop for the same period of time.

3. Obstructions in pipe. All piping must be free from burrs and other obstructions.

4. Defective material. Split pipe or fittings repaired with cement or lead must not be used. Caulked fittings must not be used.

5. Material not allowed. Unions or bushings must not be used in work that is to be concealed, and cast iron fittings are prohibited in either exposed or concealed work.

6. Work Reserved. This Company does not permit anyone but its own authorized employees to place any piping or connections on any part of either the outlet or inlet meter connections, turn on the gas, disconnect, move, or interfere in any way with its piping, meters or connections.

7. Resetting or Changing Location of Meter. If, after a meter is once installed, the customer desires alterations in the house-piping, which would necessitate the disconnecting, reconnecting or changing the location of the meter, a charge will be made by the Gas Company for this work.

8. Work Not Allowed. Gas fitters must not do any underground piping outside of a building.

9. Capping Outlets. All outlets must be securely closed with iron caps until fixtures or appliances are installed.

10. Piping on Outside Wall. When it is absolutely necessary to run pipe on an outside wall a furring strip must be placed between the pipe and the wall.

11. Piping on Masonry Walls. All piping run on masonry walls must be securely fastened thereto by strapping it to wooden plugs driven into the wall.

12. Imbedding in Concrete or Cement. When pipe is to be imbedded in concrete or cement, it must be covered with tar paper or other suitable covering, or laid in a conduit pipe.

13. Trapping Pipe. To avoid trapping pipe gas fitters must grade it to riser or to drops, except as provided in rule No. 69.

14. Breaking Sizes. In every case where an extension is to be made, pipe must be broken at a point where the full size can be maintained.

No extension must be made from a pipe of a smaller size.

15. Drops from Branch Lines. Drops on branch lines should have a set of 4 inches and they must be dropped square. Outlets for side brackets may be either square bends or long drop ells. The use of nipples is prohibited.

16. Back Pressure Valve. When compressed air oxygen or any other mixture under pressure is used with gas, an approved safety back pressure device must be placed on piping to prevent pressure backing up into meter. Before connection is made to meter such device must be approved by the company.

17. Connecting Appliances. Fitters are particularly requested to see that gas burning appliances are connected solid with iron pipe, with the exception of portable appliances which may be connected by approved metallic tubing.

18. Typesetting Machines. A linotype or monotype machine must be supplied by a separate fuel run.

Rules and Tables for Piping.

19. Understanding Rules. If, in any instance, the rules governing the size of pipe to be installed are not clearly understood, or if unusual conditions not covered by the rules are met with, the Gas Company should be consulted.

20. Single Pipe System. The following tables and rules provide for a single pipe system in either new or old buildings. However, should it be more economical to install a double pipe system, such may be installed, and outlets computed on the same basis as that for a single pipe system.

21. Fuel Only. When piping is installed for illumination in either a new or old building, an outlet must me left for fuel.

If gas for light is not desired, a building may be piped for fuel only.

22. Size of Pipe Required and Equivalents. The amount of gas passing through a ⅜-inch pipe under normal pressure is approximately 10 cubic feet of gas an hour. The capacity of a ⅜-inch outlet has therefore been called an equivalent, and the table of pipe sizes below has been figured out on that capacity and is to be used in estimating the size of the pipe necessary to give an adequate supply of gas to an appliance.

For example, a range for a flat or residence requires five times the quantity of gas supplied by a ⅜-inch pipe, or five equivalents.

Range for flat or residence	5 equivalents
Fireplace Appliance	3 equivalents
Laundry Appliance	3 equivalents
Water Heater	3 equivalents
Arc Lamp	2 equivalents

The number of ⅜-inch equivalents for any appliance not mentioned in the above table may be determined by dividing the total consumption per hour of that appliance by ten.

Consumption of gas-fired steam boilers may be obtained by assuming 80 cubic feet of gas per hour for each horsepower.

23. Size of Opening. To determine the size of the opening required when risers are connected at the meter end, the combined loads of the risers must be added together. (See table in Rule 25.)

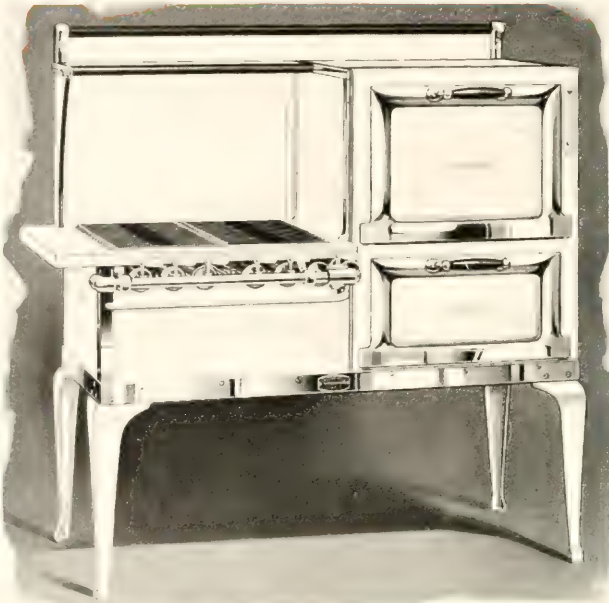
24. Size of Riser for Combined Lines. When two or more lines of pipe are connected in order to be supplied by one riser, the riser must be of sufficient size to supply the combined load of all the lines. (See Rule 25.)

25. Office Buildings, Schools, Hospitals, Residences and Flats, Under Single Pipe System.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
⅜	30	2
½	40	4
¾	60	10
1	70	15
1¼	100	30
1½	150	60
2	200	100
2½	250	200
3	300	300
4	450	500

Notes: Any ceiling 20 feet high or over must have ½-inch drops.

In a residence or a flat building, a ¾-inch outlet for a range in a kitchen may be used to supply two appliances, such as a range with a ¾-inch outlet extended full size, and a water heater or a laundry appliance with a ½-inch extension.



The Embassy

WALTER W. AHLSCHLAGER
Architect

JOHN STUT
Builder

B. LEO STEIF & CO
Architects

G. M. POSNER & CO.
Builders

26. Stores and Factories.

Size of Pipe Inches	Feet of Pipe Allowed	Number of ½-inch Outlets allowed
½	30	1
¾	60	8
1	70	12
1¼	100	20
1½	150	35
2	200	50

Notes: For stores the running line must not be less than ¾-inch to the last outlet.

Drop outlets for stores must be ½-inch in size.

27. Bracket and Window Lights. Thirty feet of ⅜-inch pipe will be allowed for bracket lights. The same length of ½-inch pipe will be allowed for window lights.

28. Piping Rooms in Rear of Store. When a store building with living rooms in the rear is supplied by one riser, the running line must be ¾ inch to the outlet for fuel.

29. Domestic and Industrial Appliances. Gas to be used at one point.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
½	80	4
¾	90	10
1	100	20
1¼	150	30
1½	200	40
2	250	60

30. City Ordinance on Water Heaters. The following city ordinance on the installation of water heaters is in effect since July, 1920.

"1902. **Permit Required to Install or Connect Gas Water Heaters.** No person, firm or corporation shall install or connect any hot water heater in any building or structure, for heating water in the same by the use of natural or artificial gas as fuel within the City of Chicago, without first having obtained a permit as hereinafter provided."

"1903 **Application — Permit — Fee.** Any person, firm or corporation desiring to install or connect any water heater in a building or structure for heating water for use in such building or structure by the use of natural or artificial gas as fuel, shall file with the Commissioner of Health of the City of Chicago, an application upon forms furnished by the Department of Health, containing the name of the applicant, the street number of the building in which the said heater is to be used (and if the building is an apartment building, the location of the apartment), the floor plan of the room, showing the proposed position of the heater, the location of the plumbing fixtures, the door and window openings, showing their dimensions, and the course of the gas duct or ventilating pipe to the outer air or to a chimney connection provided, however, that no such gas water heater shall be installed in any bath room or toilet room.

"1904. **Structural Requirements.** No person, firm or corporation shall install or connect any such heater unless it be provided with a metallic hood to which there shall be connected a suitable ventilating pipe not less than two inches in diameter, which said pipe shall extend to a chimney flue or to the open air in such a way as to carry off all escaping gases or fumes from such heater. In case such ventilating pipe shall extend to the open air, it shall be provided with a cap or cowl so as to prevent a back draft. Every such heater or gas oven shall be provided with a convenient and adequate means of access to the burners and heating surfaces, for the purpose of lighting and cleaning same. No such gas water heater shall be set closer to the floor than twenty inches, measuring from the top of the burner.

"1904a. **Automatic Instantaneous Gas Water Heaters.** All instantaneous gas water heaters, automatically controlled by pressure valve and thermostat, shall conform to the foregoing structural requirements, except that they may have pilot lights located entirely within the casing and arranged for continuous burning, and that they may be set with top of burners not less than eight inches above floor; provided, that every such heater shall be set on a non-combustible floor or a sheet metal mat or pan and that the walls behind shall be protected by a sheet metal covering to the height of the heater.

"1905. **Duty of Owner or Person in Possession of Heater.** It shall be the duty of the owner or person in possession or control of any building or structure where gas water heaters have heretofore been installed, to make such heaters comply with the requirements of this article, and it shall be unlawful for any person to use any such heater until it shall have been made to conform to the provisions of this article.

2. "This ordinance shall take effect and be in force from and after its passage and due publication."

31. Automatic Water Heaters. An automatic water heater must be supplied with a separate fuel run from meter to heater. This does not apply to what are known as Junior or Domestic Automatic Storage Heaters listed in the first column below. Large storage heaters must be supplied with a separate fuel run.

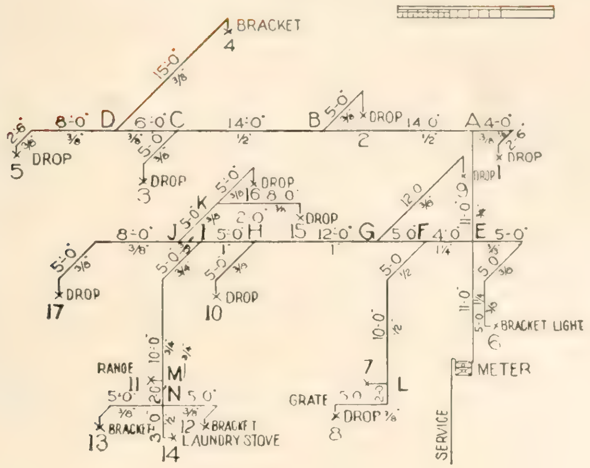
For sizes and lengths allowed see table below. For size of fuel runs to any heaters not listed below, run pipe one size larger than opening on heater. The length allowed may be ascertained from table in Rule 29.

Type	Style	Style	Style	Style	Style	Style
Humphrey	#5B-24 #5R-40	#20, #30, #2A, #50-66 #2C	#4, #3C, #4C	#6, #6C	#8, #8C	
Pittsburgh	#30-40	#40, #50, #60 #65, #50-66, #100	#4, #200 #300	#6, #400	#8, #500	
Rudd	#30-20 #30-40	#2½, #3, #50-66, #100	#4, #200, #300	#6, #400	#8, #800	
Bryant		#18, #24, 3 and 4 Sections	#30, #36, 5 & 6 Sections	#42, #48, #54, 7-8-9 Section	#66, #78, #90, #102, 11-13-15-17 Section	#114, #126, 138, #150, #162, #174 186, 19-21-23-25-27-29-31 Sections
Hoffman		#2½D, #3N	#4H	#6	#8	
Toombs		#3	#4			
Radke		#2½, #3	#4	#6		
Go-Ro		#3	#4	#6		
American			#4	#6		
Kompack	#18 #32					
Hoffman Domestic Storage System	#30 #40 #50					
Lovekin	#22 #28 #35 #45 #60					
Capacity Cu. Feet per Hour	70 or Less	70 to 200	200 to 300	[illegible]	[illegible]	[illegible] to 1225
Size Pipe in Inches	[illegible]	1	1¼	1½	2	2½
Feet Pipe Allowed	30 & 60	100	150	200	250	250
Separate Fuel Run Required	No	Yes	Yes	Yes	Yes	Yes

Chicago Theatre Lobby
C. W. and Geo. L. Rapp
Architects

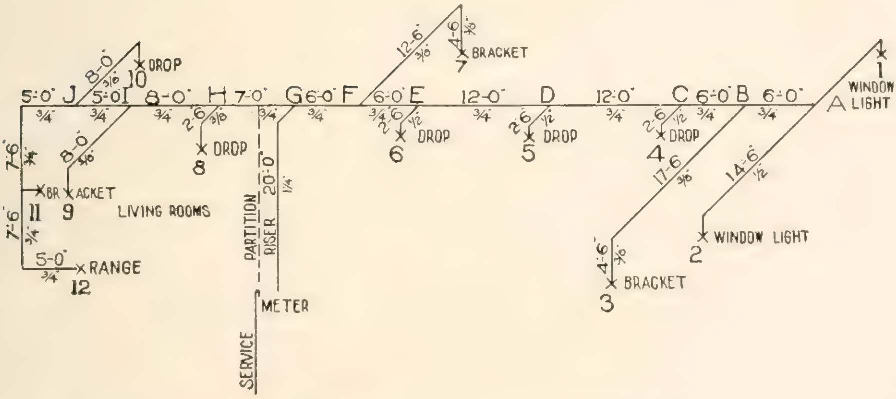
SAMPLE PIPING PLAN

RESIDENCE



SAMPLE PIPING PLAN

STORE WITH LIVING ROOMS IN REAR



32. Gas Engine. The gas supply for a gas engine must be separate. An independent service will be required, and a governing holder or other similar device acceptable to the Company must be used. Before any work of installing a gas engine or piping for one is done, consultation with the gas company is advised.

Horse-power	Size of Pipe in Inches	Feet of Pipe Allowed
1 to 7	1	100
8 to 12	1¼	100
13 to 22	1½	100
23 to 35	2	100
36 to 50	2½	100
51 to 100	3	100
101 to 150	4	200

Note: If the length of pipe required exceeds the number of feet allowed, the allowable length may be doubled by increasing the pipe one size.

33. Plans of Piping and Their Explanation.

In determining sizes of piping for a building the starting point must be the extreme end of the system and all calculations must be made from there on to the meter.

Meter and Risers and their Location

34. Location of Meter. The Company reserves the right to determine in all cases the location for the meter.

35. Locations for Risers and Meters. All risers must be located to conform with the following requirements:

All meters hereafter installed on consumers' premises must be located in the basement, or on the first floor as near as possible to the service entrance in a clean, dry, safe place not subject to wide variation in temperature. No meter hereafter installed shall be placed in coal or wood bins or on the partition forming such bins or in any location where accuracy may be seriously affected by exposure to the elements.

The following locations are specifically prohibited. Under a bulkhead or show-window, attic, sitting room, bedroom, bathroom, bedroom closet, stairway closet, over a door or window under a sink or washstand.

over a gas or electric light fixture or in any location where the visits of the meter reader will cause annoyance to the customer.

Plan No. 1. Residence.

Line	Number of ⅜-inch Equivalents supplied by line	Length	Size
5 to D	1	10′ 6″	⅜″
4 to D	1	15′	⅜″
D to C	2	6′	⅜″
C to 3	1	5′	⅜″
C to B	3	14′	½″
2 to B	1	5′	⅜″
B to A	4	14′	½″
1 to A	1	6′ 6″	⅜″
A to E	5	11′	¾″
J to 17	1	13′	⅜″
K to 16	1	5′	⅜″
K to 15	1	8′	⅜″
K to J	2	5′	⅜″
J to I	3	2′	½″
N to 14	3	3′	½″
N to 13	1	5′	⅜″
N to 12	1	5′	⅜″
N to M	5	2′	¾″
I to M	10	15′	¾″
I to H	13	5′	1″
H to 10	1	5′	⅜″
H to G	14	12′	1″
9 to G	1	12′	⅜″
G to F	15	5′	1″
8 to L	1	7′	⅜″
L to F	4	15′	½″
E to F	19	4′	1¼″
6 to E	1	15′	⅜″
E meter	25	11′	1¼″

Plan No. 2. Store with Living Room in Rear.

Line	Number of ⅜-inch Equivalents supplied by line	Length	Size
K to 12	5	12′ 6″	¾″
K to J	6	12′ 6″	¾″
10 to J	1	8′	¾″
J to I	7	5′	¾″
9 to I	1	8′	⅜″
I to H	8	8′	¾″
8 to H	1	2′ 6″	⅜″
H to G	9	7′	¾″
2 to A	2	14′ 6″	½″
1 to A	2	9′ 6″	½″
A to B	4	6′	¾″
3 to B	1	22′	¾″
C to B	5	6′	¾″
4 to C	1	2′ 6″	¾″
C to D	6	12′	¾″
5 to D	1	2′ 6″	⅜″
D to E	7	12′	¾″
6 to E	1	2′ 6″	⅜″
E to F	8	6′	¾″
7 to F	1	17′	¾″
G to F	12	6′	¾″
G meter	21	20′	1¼″

Meters shall not be set so close to any source of artificial heat as to subject them to a temperature exceeding 75° Fahrenheit. On all new installations a meter must be installed in a location where a temperature no lower than 40° Fahrenheit is maintained.

36. Risers in Laundries, etc. Risers may be run to laundries, furnace or boiler rooms, provided the risers are not placed closer than 10 feet to any appliance and in no case directly in front of a boiler or a furnace.

37. Riser for Theatre. A meter to supply a theatre may be set in a public meter room with other meters and may be supplied by the service supplying those meters.

38. Piping for Laundry Room. In a flat building where appliances, such as laundry stoves, driers, etc., are installed for the joint use of tenants, a pipe from each tenant's meter must be run to the laundry room and a header provided on the wall adjacent to the appliance. Each riser must be equipped with a lock-cock.

A metal tag with the flat number plainly marked thereon must be securely fastened to each cock.

One outlet for a light in the laundry may be taken from the end of the laundry header.

39. Vestibule Partition. A riser must not be run closer than one foot to a vestibule partition.

40. Electric Cut-off Box. A riser must never be brought to a point nearer than 5 feet from an electric cut-off box.

41. Riser in Other Apartment. A riser for one apartment must not end in another apartment.

42. Height of Risers. A riser must be placed at a height of not less than:

4 feet from the floor for openings up to 60 in number.

5 feet from the floor for 60 to 100 openings.

6 feet from the floor for any number over 100 openings.

No riser must be placed higher than 9 feet from the floor.

43. Distance Below Ceiling. A riser must extend not less than 1½ inches below a finished ceiling, or 2 inches below an unfinished one.

44. Exit Lights. When running pipe for exit lights in theatres, schools, amusement or assembly halls, the city building ordinance should be referred to.

45. Public Lights—3-Flat Building. In a three-flat building or over, outlets for vestibule, public hall and basement lights must be taken from an independent pipe, and an opening left on the building service so that a separate meter can be set for these lights. If so desired, the riser may be connected with a union, or a right and left coupling to the meter of the applicant who may wish to pay for the gas.

46. Public Lights—2-Flat Building. In a two-flat building the outlets for the vestibule and basement lights must be taken from a separate riser, the end of which must be located near the first floor riser so that these outlets can be connected. A separate outlet in the building service for the vestibule and basement lights will not be required.

Outlets.

47. Outlet for Fuel. If the pipe has been run under the floor, the outlet for fuel in a kitchen must be left 3 inches above the floor and two inches clear of the baseboard. If the pipe has been run overhead and down, the outlet must be left 3 feet from the floor and 2 inches clear of the finished wall.

48. Drops. Drop outlets in a residence must be produced 1½ inches below an unfinished ceiling, or ⅝ inch below a finished one. In a store the drop outlets must be produced 2¼ inches below an unfinished ceiling, and 1½ inches below a finished one.

49. Mantel or Fireplace. An outlet for a mantel or fireplace must be produced ½ inch above the finished bottom of the fireplace, 6 inches from the left hand side and 6 inches from the back.

Building Services.

50. Building Service Only. If it is desired to install a building service only in any building, instructions for size of pipe and openings to be left must be obtained from the district shop.

51. Size of Building Service. The size of the building service must in every case be determined by the size and number of openings.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
1	70	16
1¼	100	40
1½	150	80
2	200	120
2½	250	200
3	300	300
4	450	500

Note: All openings in a building service must be of the same size as that of the riser which in no case must be less than ¾ inch in size.

52. Building Service in Unheated Basement. A building service in an unheated basement must be graded to the street, and the tee left turned up so that any condensation forming in the pipe will run to the street and not to the meter.

53. Solid Wall Porch. In a building with a solid wall porch, the building service must be run to the front and then to the side wall.

54. Location of Building Service. When risers are located in the rear of a basement or in a room provided for that purpose, or on the various floors, the building service must be brought to within 18 inches of the wall through which the street service will be produced.

55. Wrapping Building Service. A building service run under an open porch and connecting the front and rear sections of a building, must be covered with mineral wool or steam pipe covering and boxed in.

56. Encasing Building Service. A building service laid through a masonry wall must be encased and the pipe left resting on the bottom of the casing with a 1½-inch clearance on top.

57. Opening in Building Service. The opening in a building service should always be on the left hand side of the riser which it is to supply, and 15 inches from it.

58. Building Service in Flat or Residence. A building service for a flat building, or a residence must be run overhead, and brought down in an inside partition, not less than 4 feet from an outside wall.

No building service must be run under a basement floor or under a first floor where there is no basement.

59. Building Service in Store. A building service in a store may be run overhead if the entire horizontal run of pipe can be graded to the street service. If not, it must be run under the floor.

When a building service is run overhead it must be brought down at least 4 feet from the front wall of the building.

60. Building Service Underground. When it is necessary to extend a building service underground from the front to the rear of a store or factory building, it must be encased in tile pipe with cemented joints.

61. Building Service Header. When it is necessary to set more than two meters together, a building service header must be supplied with an opening for each meter.

62. Building Services for Adjoining Stores. When it is desired to run two separate services in one trench for stores separated only by a partition, the building services may be run so that the street service for each store will come under doorway.

In such cases the Gas Company must be notified sufficiently in advance, so that services may be installed before floors are laid.

63. Bringing Building Service to Street Service. When the Company's service is into a building before the house-piping is completed, the building service must be brought directly over the street service.

64. Terminating Building Service. A building service must not be determinated in a coal hole or in any other place where it will not be easily accessible.

65. Test-pipe to Prove Work. Every building service must have a ⅜-inch test-pipe to which a gauge can be attached.

Service Pipe from Main to Building.

66. Main to Property Line. A service pipe will be run at the expense of the Gas Company from the main to the property line, except that customer will be required to pay for the replacement of pavement and sidewalk if it is necessary to open them.

67. Property Line to Building. Customer will be charged for the extension of service from the property line to the termination of service or to point where connection is to be made to the building service.

68. Service Beyond Front Wall of Building. When there are furnished rooms in the front part of the basement and the owner does not wish to have the building service appear in these rooms, it may be terminated outside of them.

The street service will be continued on the outside of the building to opposite termination of building service, provided that the pipe does not have to be laid in a space which is covered or to be immediately covered with cement.

69. Services for Stores. A building containing stores must have a separate service for each store, unless a public meter room or other public place on the floor or below that where the gas is to be used is provided.

70. Services for Apartment Buildings. In apartment buildings of 12 flats and under, only one Company's service will be required. This will make it necessary to connect the various building services supplying the groups of risers regardless of fire walls, and extend one building service to the point where the Company's service will come in.

In apartment buildings containing more than 12 flats, two or more Company's services will be allowed.

71. Services for Court Buildings. In a building which faces on a park-way or has a park-way or court in the center, the Gas Company will run one service in the court or park-way, and branch therefrom to supply the various building services.

The gas fitter may run building services through fire walls and connect them, but these must be extended as close to the front of the building as possible.

Any building service in a court building must not be terminated in a finished room.

See sketches of court and parkway buildings, pages 32 and 33.

72. Locating Service to Corner Building. To avoid complications when working on a corner building, the gas fitter should obtain from the Gas Company a written notice giving the exact location where the Company's service will enter the building.

73. Building in Rear of Corner Lot. A building on the rear of a corner lot must be supplied from the side street if a gas main is on that street. If not, it may be supplied either from the front building or directly from the main, whichever is the more practicable.

74. Building in Rear of Lot. When a building in the rear of a lot is to be supplied, a separate service should be used wherever possible. If, however, an independent supply is not practicable, the building service for the front building, if there is one, must be extended to the rear of the building, and of a size not less than 1½ inches so the rear building can be supplied from it also.

In all cases where a supply to a rear building is desired the Gas Company must be consulted.

75. Two Services in One Trench. When two services are to be installed from a main in a paved or unpaved street to supply two (2) buildings under the same or different ownership, if these buildings are not more than fifteen feet (15 ft.) apart, such services may be run in one trench to a point inside the lot line, and then branched, one to the right and the other to the left, to the respective buildings, being sure that each service is laid in its respective lot.

76. Opening in Wall for Service. In a new building, an opening should be provided in the wall for the Gas Company's service. The most preferable way is to build a sleeve of wood, rectangular in shape, 12 inches by 5 inches, with an inside partition about 6 inches from the street end of the sleeve.

Application should be made to the Main Office of the Gas Company to locate the wall and the point in the wall wherein the sleeve should be built, so that when the service pipe is run, it will pass through the opening provided therefor. In this way the damaging of foundation walls will be avoided.

77. Opening in Floor for Service. When a service connection may have to be made above the floor level, an opening must be left in the floor so that the street service can be introduced. The district shop will, on notification, instruct the gas fitter where to leave this opening.

78. Reconnecting or Altering Service. If a building has been moved or altered necessitating the disconnecting, reconnecting or changing location of service, the work will be done by the company at cost.

Location of District Shops.

Following are the locations, boundaries and telephone numbers of the various district shops.

These numbers should be called when it is desired to communicate with shop inspectors.

North Shop. 1741 Kingsbury Street. Telephones—Diversey 5261 and 5262. Boundaries—North—City limits. South—Fullerton Avenue from river to city limits and 12th St. from river to Lake Michigan. East—Lake Michigan. West—The river from 12th Street to Fullerton Avenue and city limits from Fullerton Avenue North.

South Shop. 38 W. 64th Street. Telephones—Wentworth 1927 and Normal 8200. Boundaries: North—12th Street from Lake Michigan to the river and the river and canal from 12th Street to the city limits. South—city limits. West—city limits. East—Lake Michigan.

West Shop. 164 North Sheldon Street. Telephones—Monroe 0873, 3497 and 3498. Boundaries: North — Fullerton Avenue. South—Chicago river and the Canal. East—Chicago river. West—city limits.

SUGGESTIONS FOR THE PROVISIONS OF WIRING AND CABLING OF BUILDINGS FOR SERVICE OF ILLINOIS BELL TELEPHONE CO.

The extensive use of the telephone in office buildings, hotels and large apartment buildings renders it essential that a provision be made in all modern buildings of these types, in advance of their completion, for carrying the requisite number of wires necessary for furnishing telephone service.

Where a private branch exchange switchboard or a building basement terminal is installed it is necessary to carry at least two wires from each telephone to the central distributing point in the building. Where these buildings are furnished telephone service by means of cable it is generally necessary to extend a building cable and establish one or more branch terminals, from which the distributing wires are taken. Hence, the importance of making adequate provision in advance for such building cabling and wiring.

It is advisable to have such provision included in the building plans. Otherwise the walls may be disfigured by unsightly open wire runs, or it will be necessary to make openings through the walls, floors and partitions after the completion of the building.

The Telephone Company will be pleased to furnish the owner or architect with all necessary information as to size, type and location of conduits. Building wiring may be logically divided as follows:

(1) APARTMENT BUILDINGS.

The term apartment buildings as used herein means buildings larger than single houses or stores and smaller than office buildings. Such buildings may contain living and office apartments, also stores, generally on the ground floor.

In an apartment building the maximum number of telephones in any one apartment, or on any floor, is quite definitely fixed, generally one per apartment.

Vertical building conduit, with an outlet at each floor, should be installed in each tier of apartments in an apartment building, of not more than three stories. In Buildings of more than three stories shafts should be provided and conduits installed from room outlets to these shafts.

(2) OFFICE BUILDINGS.

The wiring of an office building presents a difficult problem for the following reasons:

The number of telephones will depend largely upon the character of the business and district. The number of telephones on any floor of these buildings will depend upon the requirements of the individual tenants This is not constant for any extended period, as tenants may from time to time be replaced by others using more or less service.

In office buildings where the floor is likely to be divided into a large number of rooms or offices the distributing wires from the floor terminals to telephones can be run in moulding. The floor terminals should be located near the ceiling. A suitable moulding should be provided in the halls for carrying the wires from the terminal boxes to the various rooms. A smaller moulding should also be provided in the individual rooms, or suites of rooms, for carrying the wires to the proper location desired.

At certain intervals, depending upon the arrangement of the building in question, it will be desirable to have a piece of conduit extend across the ceiling of the hall in order to distribute from the floor terminal on one side of the hall to the rooms on the other side of the hall, in case there is no terminal on the other side.

With the system above described, the wiring is practically concealed and the system

is flexible enough to allow proper distribution of facilities among the various rooms on the floor.

In large office buildings it is necessary to have a cross connecting terminals—to afford means for getting connections between different floors. In the case of very large buildings a small room should be designed for this in the basement.

When an entire office building, or several floors of a large building, is devoted exclusively to the purposes of one firm, some floors are generally not subdivided into small rooms, yet it is necessary to supply telephone service to many desks in the large rooms, and it is desirable to have the telephone wiring concealed.

If the room has columns and the desks can be grouped along the walls and about the columns, outlet boxes can be placed adjacent to these groups of desks and these outlets connected to distributing centers by iron conduits, as described under "Hotel" wiring.

Where a very large use of telephones is contemplated, outlets may be placed in the floors on approximately five-foot centers, which outlets are connected to distributing centers by a lateral system of ducts or iron conduits.

(3) HOTELS.

Depending upon the size and location, type and kind of building and character of service contracted for, a hotel may be included in either the office building class or the apartment building class or a part of both.

The telephone system installed in hotel buildings consists of a telephone switchboard located at some convenient point, usually on the ground floor, in or near the office. Telephones are placed in each room or suite and wired to the switchboard, which is connected by one or more trunk lines with the nearest exchange of the Telephone Company. The wiring problem is, therefore, comparatively simple, involving the running of a pair of wires from some definite point in each room or suite to a common center near the switchboard location. Provision should also be made so that the Telephone Company can run its trunk wires from the switchboard to the point at which the telephone cable enters the building from the street, usually in the basement.

The method of getting wires from the common point (switchboard) up through and to the various floors, also the provision for terminating service cables, is the same as above described for cabling of office buildings.

From the floor terminal a conduit is run to a designated location in the wall of each room in which a telephone is to be placed. The height of the outlets in each room should be about five (5) feet from the finished floors for wall type telephones and eighteen (18) inches for desk type telephones; this will depend largely upon the desire of the hotel architect or owner. A one-half (½) inch (inside diameter) conduit should not be over fifty (50) feet in length, nor have more than three bends with a minimum radius of five (5) inches. Any conduit one hundred (100) feet in length should not be less than one (1) inch inside diameter. One-half (½) inch (inside diameter) conduit should be provided for a maximum of two pairs of wires; three-quarters (¾) inch (inside diameter) conduit for five pairs; and one (1) inch (inside diameter) conduit for nine pairs. In extending conduit from terminal boxes to rooms it is possible in many cases to use one run of larger conduit to supply three or four rooms, rather than run smaller conduit to each individual room. When the floor area and the number of rooms are large it may be found economical to have more than one terminal box on a floor

Cable.	Twisted Pairs.	Conduit Straight Run Less than 75′.	Conduit Straight Run More than 75′.	Conduit Run Less than 75′. One 90° Bend.	Conduit Run More than 75′. One 90° Bend.	Outside Diam. of Cable.	Size of Pull Boxes.
	2	½″	½″	½″	¾″		4″x4″ 2″ deep
	4	¾″	¾″	¾″	¾″		6″x18′ 4″ deep
25-pr.		1″	1″	1″	1¼″	23/32″	6″x20″ 4″ deep
50-pr.		1¼″	1½″	1½″	1½″	29/32″	6″x20″ 4″ deep
100-pr.		1½″	2″	2″	2″	1 3/16″	8″x24″ 6″ deep
200-pr.		2½″	2½″	2½″	2½″	1¾″	10″x30″ 8″ deep
300-pr.		3″	3″	3″	3″	2 1/16″	12″x32″ 8″ deep
400-pr.		3″	3″	3″	3″	2⅜″	12″x32″ 8″ deep
600-pr.		3½″	3½″	3½″	3½″	2¾″	12″x36″ 10″ deep

Conduits smaller than 1″ are objectionable for lead covered cable because they are frequently deformed during construction of building.

All runs exceeding 100 feet in length
All runs having more than two 90° bends
All runs having bends sharper than 90°
} should be provided with pull boxes.

SPECIFICATIONS FOR ERECTING METAL LATH

Recommended by the Associated Metal Lath Manufacturers.

GENERAL.

Flat Metal Lath for inside walls and partitions and other vertical positions or for fire-proofing columns, brackets, ducts and vertical furring, where tied to steel, shall weigh not less than 2.5 pounds per square yard; where attached to wood shall not weigh not less than 2.3 pounds.

Flat Metal Lath for ceilings and other horizontal positions shall weigh not less than 3.0 pounds per square yard tied to steel, or 2¾ pounds if attached to wood with supports spaced not greater than 16 inches center to center.

Flat Metal Lath for exterior stucco work shall weigh not less than 3.4 pounds per square yard.

Ribbed Metal Lath shall not weigh less than the minimums above, but the spacing of supports shall be in accordance with the published recommended practice of the manufacturers thereof.

Sheet Metal Lath shall weigh not less than 4½ pounds per square yard with supports for non-bearing partitions and ceilings not more than 24 inches on centers, or for bearing partitions not greater than 16 inches on centers.

Staples shall be 1¼" by 14 gauge smooth wire, driven to a penetration of at least ⅞ in. over furring, staples shall be 1½" long.

Nails shall be not less than 4d, for flat metal lath and where ribbed lath or furring is used, 6d nails shall be used. They shall be driven to at least ⅞" penetration and shall be bent up to engage at least one strand without breaking.

Tie Wire shall be not less than No. 18 gauge black annealed lather's wire, excepting for suspended ceilings where galvanized annealed wire shall be used.

WOOD STUD AND JOIST CONSTRUCTION —INTERIORS.

The metal lath shall be placed with the long dimension (8 feet) across supports and fastened by nailing or stapling every 6 inches. Staples shall be placed astride the furring, nails shall be bent over the furring. Staples shall be placed not less than ½" on the sides and tied once with wire between supports. Ends shall be lapped not less than 1" over supports.

The lath is first applied to ceilings and carried down 6 inches onto all walls and partitions.

In corners all lath shall be started one stud away from a corner and be bent into the angle and carried on to the abutting wall so as to avoid a butt joint in the corner.

On walls and partitions the lathing shall be started at top and carried down, the lower sheets lapping over the upper sheets, the lap being not less than ½".

SUSPENDED CEILINGS.

Hangers—(The vertical members which carry the steel framework) shall be placed not to exceed 4 feet center to center in either direction. Where suspended below concrete construction they shall be placed before pouring concrete; below flat arch hollow tile they shall be fastened to toggle bolts inserted after tile are placed, or by hangers extending completely through the block. Where steel beams or purlins are not more than 4 feet center to center, hangers may be attached directly to them.

The minimum size for hangers shall be No. 8 galvanized wire, 1 by $\frac{3}{16}$ inch flats or [illegible] inch round mild steel rods. The wire shall be attached by twisting three times,—flats attached by bolting with ⅜ inch bolts,—rods by twisting twice, or by right angle bends and wiring.

Runner Channels—(The heaviest horizontal members) shall be placed not to exceed 4 feet on centers, shall be bolted to hangers, or suspended by securely twisted loops formed in the lower ends of the hangers.

Runner channels shall be not less than 1½ inch channels with a minimum of .442 lbs per lineal foot.

Furring Channels—(The smallest horizontal member to which the lath is attached) shall be not less than ¾ inch channels with a minimum weight of .276 lbs. per lineal foot, attached to runner channels by at least three loops of No. 16 galvanized wire at each crossing. They shall be set on various centers, depending upon the lath to be used. A maximum of 11¾ inch centers shall be used for 3 lb. flat lath, 15¾ inch centers maximum for 3.4 lb. flat lath, 19 inch centers maximum for 3 lb. Rib Lath.

Metal Lath—(The plastering base and reinforcement) shall be wired to the furring channels, the long dimension (8 feet) of the sheet being across the channels, by No. 18 gauge annealed galvanized lather's wire, every 6 inches along the furring channels. Sheets shall be lapped not less than ½ inch on sides, and not less than 1 inch on ends, and be tied once between supports.

SOLID PLASTER PARTITIONS.

Studding used for solid partitions shall be ¾" cold or hot channels 15¾" center to center for partitions not to exceed 16 feet in height and 1" channels for greater height properly braced during plastering. Where ribbed lath is used, the partition shall be erected in accordance with the standards as published in the recommended specifications of the manufacturers thereof.

Channel studs may be held in place by springing into holes drilled in floor and ceiling. On wood floors, channel shall be secured by bending to an angle and spiking; or they may be set in shoes.

Metal lath shall weigh not less than 2.5 pounds per square yard and be fastened to the channels, with the long dimension of the sheet across the channels, by wiring every 6 inches.

Sheets shall be lapped not less than ½" on sides and wired once between supports and lapped not less than 1" at the ends over supports.

All lath shall be started at least one stud away from a corner and be bent into the angle and carried on to the abutting wall to avoid a butt joint in the corner.

Lathing shall be started at the top of the partition and carried down so that the lower sheets lap over those above.

ECONOMICAL METAL LATHING SPECIFICATIONS.

Every plastering specification for residences in which wood lath predominates should call for metal lath over the **heating plant** and **fuel storage** and on the **bathroom wainscot.**

In addition to this, the following two alternates are suggested.

ALTERNATE I.

(1) Use metal lath on the ceilings of the living room, dining room, entry hall, and around and under the stairs and stairwell where exposed to view from the main floor.

(2) Use a 12-inch strip bent into the corners of the living room, dining room and entry hall (to prevent corner cracks).

ALTERNATE II. (In addition to the above.)

(1) Use metal lath for the walls of the living room, dining room and entry hall.

(2) Use metal lath for the balance of the basement ceiling.

STRUCTURAL BUILDING STEEL

By Frank J. Llewellyn, Member American Society of Civil Engineers

ARTICLE III

The discussion of the subject of STRUCTURAL BUILDING STEEL which first appeared in the 1920 edition of the Handbook was based largely upon the special conditions which had been brought about as the result of the World War. Of the numerous features considered, it apparently was in the commercial analysis that the interest and possibly also the value chiefly centered. Thus is afforded some criterion for the present article, which, in bringing the discussion down to date, will at once present a review of the price movement which has occurred during the entire intervening period.

We have already seen that with the abandonment of the wartime base price of structural steel, an initial reduction was made by the steel makers, which went into effect on January 1st, 1919. A further reduction, which complied with the recommendations of the Industrial Board, became effective March 21st, 1919. These two, approximating $12.00 per ton, left the base price on standard structural material at $2.45 per hundred pounds f. o. b. cars Pittsburgh; which base price prevailed for many succeeding months, and on the part of the largest of the steel makers of the country probably was not exceeded. Thus it was that building construction generally was not subjected to any handicap resulting from inflated prices at that time, as applied to the rolled material itself. In other directions, however, steel demand was still so great that this situation was taken advantage of by numerous concerns, whose appetite for high prices was not yet abated to market their material at extreme figures; so much so that the trade journals in their weekly reviews took cognizance of this fact, dividing the mills into two classes: on the one hand those maintaining the base which had been approved by the Industrial Board; and on the other hand, those quoting much higher rates such as the unusual conditions made it possible for them to exact; the latter ranging as high as $30.00 per ton in excess of the former. In addition, a considerable quantity of material was marketed, for employment along special lines, at prices which involved a further premium to these manufacturers greatly beyond even the highest of the published quotations.

These conditions characterized nearly the whole of 1920; but as the year drew to a close a distinct change became apparent. The general demand had begun to fall off, and this movement developed so rapidly and went to such extremes that by the middle of the year 1921 ingot production, which of course means the steel produced for all purposes, had dropped from the maximum rate which had been reached during the month of September, 1918, of 153,289 gross tons per day, to the low rate of 36,713 gross tons per day. Under circumstances such as these, the sensational prices of those who had been operating at the higher levels dropped to the rational and moderate basis which had been adopted by the leading mills as the result of the conferences held with the Government at the beginning of the year 1919.

But they did not stop at that point: the Stabilization, so grateful in a market whose trend had been violently upward, was no longer welcome under the reversal which had taken place in the relation between supply and demand; prices dropped lower and still lower, until both rolling mill and fabricator were operating at a level which effected a serious drain upon their resources.

Thus had Steel fallen from its high estate, and from Prince, almost at a single bound had become Pauper. The climax, however, was not reached until the present year; for although with the month of August, 1921 an increase in demand had set in, which by the beginning of 1922 was already resulting in the booking of really promising tonnages, this, incongruous as it may appear, was accompanied by drop after drop in the price, the limits of which cannot be exactly defined, for it is the impression that the lowest quotation on structural shapes appearing in the trade papers—namely, 1.35c per pound Pittsburgh—was shaded to an appreciable extent in numerous actual transactions. Such figures as these are far below the cost of production, and with steel operations still continuing at so great loss, dividends were either not paid, or were provided from accumulations.

Our comparative table, corrected to September 7th, 1922, shows most vividly the havoc that had been wrought. With steel skeletons fallen to the low point of $46.00 per ton delivered Chicago, a drop of approximately $77.00 per ton is noted since the maximum of $122.60 per ton which had been reached in 1920.

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YEAR	PIG IRON No. 2 FOUNDRY Price per gross ton—delivered Chicago		BESSEMER BILLETS Price per gross ton—delivered Chicago		STEEL SKELETONS Price per net ton—delivered Chicago		40 STOCKS	
	High	Low	High	Low	High	Low	High	Low
1900	$23.85	$14.70	$38.00	$19.50				
1901	16.00	14.50	30.50	22.70		$45.60		
1902	23.35	16.00	35.50	30.50	$64.20	48.60		
1903	23.45	14.50	33.50	26.00	52.40	42.20		
1904	17.70	13.50	26.00	22.50	51.80	42.20	$ 85.00	$58.00
1905	19.60	16.50	29.00	25.00	58.70	54.00	100.00	79.00
1906	25.85	18.50	32.50	29.00	54.00	44.00	114.00	99.00
1907	26.85	18.40	33.30	31.00	56.60	53.60	111.00	67.00
1908	18.75	17.05	31.00	28.00	71.00	45.60	91.00	68.00
1909	19.30	16.70	30.50	26.00	54.80	40.00	106.00	88.00
1910	19.30	15.80	30.50	26.00	52.00	44.00	104.00	78.00
1911	15.80	14.30	26.00	22.20	44.00	39.40	95.00	82.00
1912	18.30	14.30	30.00	22.75	49.60	36.40	102.00	89.00
1913	18.50	14.20	31.50	23.00	61.20	46.60	94.00	77.00
1914	14.75	13.00	24.00	22.16	48.60	37.26	88.00	68.00
1915	19.00	13.30	34.16	22.16	59.00	34.10	102.00	72.00
1916	30.50	18.50	63.16	35.16	94.00	63.80	109.00	92.00
1917	55.50	30.50	103.16	50.66	105.00	95.00	102.00	68.00
1918	34.50	31.50	52.00	48.00	119.00	91.00	91.00	70.00
1919	40.50	27.25	52.40	43.00	110.00	79.00	100.00	80.00
1920	46.70	33.70	69.30	49.52	122.60	92.00	111.00	58.00
1921	32.70	18.95	49.52	35.02	83.60	48.00	78.00	65.00
1922*	32.60	18.70	43.42	34.02	76.00	46.00	97.00	77.00

*To Sept. 7th.

The past several months, however, have seen the inauguration of the inevitable movement towards more normal conditions, resulting in a thoroughly healthy demand, sufficient certainly to place in operation better than 75% of mill capacity, which within so short a time is all the more remarkable, in view of the very great increase in furnace and rolling mill equipment which was provided during and immediately following the war period. From this point a further steady improvement may surely be counted upon, except as interfered with by industrial strife, which for the moment has come to be the fashion. The improved demand has at length also effected an increase in the selling price of structural building steel. This, however, will not be fully reflected in current balance sheets, because there is still a large amount of low priced tonnage on the books of the steel makers, some of which indeed is yet to be invoiced at the lowest figures. With this once out of the way and the mills working entirely upon the current market base, the loss on operations will have been considerably reduced, even if it shall not have entirely disappeared; and it is not improbable that statements for the month of August will for the most part show figures that have climbed completely out of the red. The recovery to date (September 7th) finds fabricated building steel of standard construction at a market valuation, f. o. b. cars Chicago, ranging from $66.00 per ton for rectangular warehouses of simple and heavy construction, to $77.00 per ton for office buildings of lighter construction and whose lines are irregular.

It would be of great value and interest to owners, engineers, architects and contractors if the course of the future price movement could be correctly forecast; and although this is impossible, there are certain features which are clear enough. With wages at their present levels and indeed likely to move higher; with no increase in the rate of production, and with other costs unabated, operations at the current market prices would continue either at an actual loss, or so nearly so as presently to be fatal. Structural steel can well stand an increase in price and still be one of the cheapest, if not actually the cheapest, of the more important materials entering into building construction. This one thing is certain: either selling prices must be increased, or costs must be greatly reduced; and while the latter may in the course of time and after some bitter experiences be achieved, it is the former which may be anticipated with considerable certainty for the period now before us.

Next perhaps in importance amongst the outstanding features of the year has been the **drift toward consolidation.** It has been widely claimed that there is some direct relationship between this movement and the conditions entering into the question of the so called **Pittsburgh basing point;** a subject which is now and for some time past has been under Government investigation; and it may easily be that the paralleling of these two movements is something more than a coincidence. As to the **consolidations** themselves, it would seem that the larger of the independent steel manufacturers must have now reached the conclusion that an increase in their raw material holdings, and a greater diversity in their products, are essential to a lowering of their costs and to a more profitable marketing of their manufactures; and it is of considerable interest to note that in developing their plans they have been able to secure from the

Government an opinion in advance, passing upon the propriety or otherwise of the course proposed.

There is existent distinguished criterion indicating the soundness and probable success of such action when well conceived and ably directed. That there is necessity therefor—as changing conditions call constantly for new adjustments—is by no means improbable.

Time was when iron and steel could be produced with little or no success outside of the vicinity of Pittsburgh. This was the convenient and most economical point-of-coming-together of the iron making materials; ore, fuel, limestone; and the price of iron, and later of steel, rested upon the cost of manufacture at Pittsburgh, plus the profit which the market afforded, plus the freight to destination. The successful establishment of iron and steel manufacturing plants in other parts of the country therefore depended entirely upon two primary questions: First, the amount of tonnage which the territory tributary to the proposed new plant could absorb; and second, the cost of production at the new center as compared with the price at which Pittsburgh, with its long start and superior conditions, could profitably sell its products in the territory in question. That the cost of manufacture itself would at that earlier period be greater elsewhere than at Pittsburgh was abundantly proven; and more than one adventure into this field proved disastrous, because too late it was found that Pittsburgh could manfacture at its cost, add its profit, pay the freight to destination, and still be at a selling price below the cost incurred by the local manufacturer.

Meantime, while economies in the Pittsburgh operations multiplied, experience tempered and directed also the efforts which were being continued elsewhere. In addition, both the center of consumption and the point of economical assembly of steel making materials were moving West; and under these conditions, large operations at numerous important and widely separated points, East, West and South, have been successfully and permanently established; so much so, indeed, that today the impression popularly entertained is that the cost of production of structural steel rolled, for example, at Chicago, is as low as of that rolled at Pittsburgh: based upon which there has been born the thought that if this supposition can only be proved, and if, then, it can be advertised with sufficient vehemence, it can be made to bring about a substantial reduction in the selling price not only of structural steel, but also in that of steel employed for many other purposes; and it is this thought, this very human desire, upon which is based the widespread agitation which has as its subject the alleged practice of "Pittsburgh Plus."

Now, it is not within the purpose of this article either to deny or to acknowledge the existence of this so called practice, nor to approve nor deprecate any of the features which are being called in question. The purely personal views of the writer would not weigh against the minute evidence which is being laid before the commission. The facts themselves will beyond doubt be fully established, and no haste need be exercised in trying to anticipate them. But with much earnestness is it suggested that within the view which is in the minds of those who are so seriously protesting, this thing really does not exist at all. Furthermore, when all the facts shall have been spread out, and thereafter, when the Government shall have expressed its opinion, its verdict thereon, either of approval or of disapproval, with equal earnestness is it suggested that this almost certainly can make no slightest difference in the price at which structural steel will be marketed. The basis of this conviction is that while prices are **influenced,** they are not **fixed** by costs; neither are they fixed, or if fixed, they cannot be maintained as the result of gentlemen's agreements or of delightful foregatherings around the dinner table. On the contrary, they are **fixed by competition** and by the simple law whose operation is governed by the relation existing between supply and demand.

To run through the story: Evidently the cost to steel makers of material produced at Pittsburgh and sold for Chicago delivery can never escape the freight charges for carrying it from Pittsburgh to Chicago, and this must necessarily be included in the selling price. But the complaint which is made is that the Chicago steel makers, whether they be independents or associated in larger consolidations, adopt this same sum total figure as their own selling base price on the material which they roll at their Chicago mills, notwithstanding the fact that the freight from Pittsburgh to Chicago is in their case not involved and does not enter into their cost. Let us see how this complaint compares with the actual facts: In the year 1920 the **market** price on plain structural shapes in Chicago ranged from three to forty-three dollars per ton **higher** than the Pittsburgh price plus the freight. In the early part of 1921 the **market** price in Chicago was probably as much as six or seven dollars per ton **lower** than the Pittsburgh price plus the freight. Instead, then, of the Pittsburgh steel makers dictating the selling prices of the Chicago mills, as has been most widely inferred, it becomes evident that the Chicago steel makers determine their own selling base, which is nothing more, nothing less, than the highest price at which they can from time to time market their output. When it is to their interest, and the market permits them to sell at prices which prove to be higher, and sometimes greatly higher, than the Pittsburgh prices plus the freight, they do so, and when lessened demand provokes keener competition, they are guided by nothing but their own best interests and their most carefully considered business judgment in de-

termining the lowest figure at which they will continue to make sales, which similarly oftens proves to be much below the Pittsburgh price plus the freight. The Western Mills may be expected to exert themselves to keep their plants running to capacity. It may equally be accepted that they will not bid any lower than is just necessary to accomplish this result. Whether a scrutiny of their costs would or would not show that they could **afford** to bid lower would seem to have nothing to do with the matter, so long as competition does not make it **necessary** for them to bid lower.

Scarcely conceivable is it, then, that the Government will undertake to settle by law the price limits to be observed. In the case of public utilities, yes. Here the supervision —municipal, state and national—goes into great detail and extends to the prices at which the service rendered may be marketed; but to price control of ordinary manufactures, subject to the customary conditions of barter and exchange, determination by the Government has rarely, if ever, been asked to extend; and the protestants in this one case probably have not realized the extent of their own certain resentment should the Government be importuned to fix the selling prices at which the particular manufactures in which they themselves are interested are to be marketed.

The whole matter really gets back to the one feature of competition; and introducing by way of simple illustration the reflection that a general store, for example, doing business at a preferred location and securing excessive prices, would beyond any question very soon find its territory invaded and would see its monopoly disappear, it becomes easily evident that in order to prevent the possibility, if that be regarded as an injustice, of steel being marketed in Chicago by Pittsburgh mills, at what must always mean the **Pittsburgh** price **plus** the freight, all that is necessary is to arrange for the production by Illinois and Indiana mills of all the steel that can be absorbed in the territory commercially tributary thereto, and at a cost sufficiently low to underbid the Pittsburgh quotations plus the freight. This of course, would mean **expansion of existing facilities,** a problem which is surrounded by the utmost difficulty. Nevertheless, it is a fact that plans for such expansion are constantly under consideration. Sites are bought, leased or optioned long in advance of their possible use; and it may be taken for granted that whenever conditions demand it, and the probability of success is indicated with sufficient clearness, the work of extension and of new construction will go forward; but always has this been one of the most perplexing of questions, even in the case of mills already in long and successful operation. It involves the prodigal spending of money for labor, fuel and time-saving devices, in order that tonnage may be at the maximum and cost at the minimum. Generally has it been that expansion has taken place under the pressure of enormous demand; and then, as the new capacity became ready the demand receded; so that there has been period after period of over building, then of waiting, and then of catching up. Developments such as these demand wisdom, experience, fearless ability, and the support of well-nigh unlimited capital. Much more simple would it indeed be if costs could be reduced, as is being sought, by means of instructions thereon to be issued by the Government.

If the foregoing discussion justly represents the facts in the case, it would seem that a real **economic waste** may be the net result of the expenditure of the large sums of money which are involved. Still more clear is it that costly investigations and commissions of inquiry, such as now seem to be the order of the day, and whose origin lies solely in the realm of professional politics, must multiply the economic loss into extreme figures. Add to these the cost of the unrest which has characterized the industrial world during the past two years, and the result is appalling. An estimate was made and published by one of the trade journals in the month of July, showing the results which are being suffered in connection with Railroad, Coal Mining and Textile strikes, indicating a monetary loss therefrom that was proceeding at the rate of over eight million dollars a day; a calamity than which only one thing of its kind could be more serious; namely, a compromise which surrendered correct principles and which therefore would entail an early recurrence of similar or greater complications. Meanwhile, the **steel industry,** hindered and hampered in common with all legitimate business by today's most difficult conditions, has painstakingly been pursuing its plodding way towards the accomplishment of economies whereby to cheapen its output, it may be to the extent of a penny a ton, or perhaps five cents, or possibly a dime; or if it were as much as a dollar, this would mean no more than thirty or forty millions in the course of a year, as against waste from all sources which may not infrequently reach an equal sum daily.

To these various lines of effort reference has been made in the previous articles. Two years ago we were heralding the advent of **rolled sections** of new and greatly improved outlines. That no comprehensive disposition has as yet been made of this subject is indicative of the minuteness of the studies and the thoroughness of the solution that will follow, rather than of any diminution of interest; and it is probable that before the publication of next year's Handbook the new sections will have been determined and will have been made available for use.

That progress has been made in the application of **arc welding** to the construction of structural steel buildings is illustrated by two recent and wholly successful practical examples: A building 40'x40'x40', employing this process and requiring 34,339 lbs of structural steel in its construction, has been completed in the Schenectady Plant of the General Electric Company. The second undertaking consisted in the construction of a crane runway in one of the factory buildings of the same concern. Quite complete details of these installations are to be found in the Iron Age of May 25th, 1922, and in the Welding Engineer of the same month. The former also gives some of the comparative figures which are said to enter in, which figures, together with observations taken through the investigation, are said to "show convincingly that at times fabrication can be conducted more easily, and at greater convenience, by using welding rather than riveting methods. Labor charges are reduced and time saved, because no material need be handled twice, everything can be done in such a way that there is a minimum of lost motion." With this matter thus brought one step nearer, however, arc welding in place of riveting, as applied to important building construction, must still be regarded as a far cry.

The discussion of last year upon the subject of **Reinforced Concrete** has been carefully scrutinized with relation to the progress made since that time, resulting from which are now added the followig suggestions:

It is undoubtedly true that the Mechanics of reinforced concrete is being studied with increasing thoroughness, and it is promised that when this shall be thoroughly understood, reinforced concrete columns to carry the heavy loads of tall buildings will be designed within the same approximate dimensions that are involved in the all steel column as customarily built and properly fireproof. It is also claimed with much conviction that in the case of bridges of long span, say 300 to 400,' even where the arch form of design is permissible, the composite of the two materials will be found to produce the best and most economic structure. Along these particular lines development perhaps may have hardly more than commenced; but no matter how far this may go, no alarm apparently need be entertained by the steel makers; for based upon the experience of the past, expansion in concrete work, instead of being at the expense of steel, as was once thought, really results in a larger call upon the steel mills, no less than six hundred thousand tons of steel for reinforcing of concrete having been produced in the year 1920.

By no means unrelated to this phase of our discussion is the employment of **Steel in Dwelling Houses.** In the August 3rd issue of the Iron Age, on Page 291, there appears a short but striking article upon this subject, the introduction to which calls attention to the fact that in recent months there has been remarkable activity in the erection of dwelling houses, and goes on to say that "it is to be regretted that conditions were not ripe for this unusual opportunity to be embraced for the introduction of steel in the framing of these buildings. From all angles this substitution, long predicted and certain to occur some time, would be advantageous. The steel industry would be glad to have this additional outlet for its steel. The owner of the building would be much better satisfied, since he would have a more durable building. The occupant would feel safer and be more comfortable. The general public would be advantaged in fire losses being reduced in the long run and insurance rates coming down in consequence." The specialists who have brought these particular details of construction to their present state of efficiency—a valuable analysis of which is found in Mr. Stanley Macomber's excellent article in last year's Handbook—may, we think, take considerable pride in the extent to which steel sections and "steel lumber," to replace wood joists and studding and wood or brick outside walls, can now be employed.

In the same issue of the Iron Age, most interesting and valuable reference is made to late developments which have occurred in the matter of the Schoop process for the application of steel construction of **Protective Coatings of Sprayed Metal.** Regarded not so long ago as merely a laboratory achievement of small practical value, today this process has become of wide commercial usefulness. From the article just referred to, we note that the different Schoop processes depend upon the generation of sufficient heat to melt wires or powdered metal, the molten particles then being forcibly projected by a blast of compressed air. The velocity of the atomized metals suffices to cause them to adhere by reason of their impact to the receiving surface, and also to insure their uniform distribution. From the same article we learn that the French have, by means of this process, recently galvanized the transmission towers of the Midi Road, the said towers being zinked in this way without any interruption to traffic. A number of bridges also have been galvanized in this manner, by recourse to portable outfits; and the parts of these structures directly in the path of the smoke-stack exhaust of steam locomotives have been further shielded from erosion by a supplemental film of lead deposited by the same apparatus. It is stated that the sprayed-on metal will last anywhere from eighteen to twenty years, while there are instances in which two coats of paint are being saved by metalizing wood with zinc and afterward covering the deposit with a coat of paint.

In conclusion, we must with even increased seriousness reflect that the vital necessity still is a steady **Increase in Production.**

That production, labor, credit and transportation the factors upon which alone our economic equilibrium depends—must be coordinated and required to cooperate, instead of being exploited and set by the ears by self-seeking politicians or professional fomenters of disputes:

That labor, whether physical or professional, must once more come to take an honest pride in its work, with the determination that the service performed shall not fall short in value of the wage received:

That misunderstandings between employer and workman can and must be seriously approached and broadly and generously adjusted; while viciousness manifested either by the one or the other, to the prevention or control of which due processes of law are seen to be entirely inadequate, must be promptly repudiated through the overwhelming weight of public disapproval.

RECENT DEVELOPMENTS IN CONCRETE

By H. C. Boyden, C. E. and B. S.

The art of making concrete is an old one, but it is only in recent years that serious large scale investigations of its structure and the real effect of various combinations of the ingredients, have been undertaken.

In 1914 the Structural Materials Research Laboratory was established at Lewis Institute, Chicago, with Professor Duff A. Abrams at its head. The establishment of this laboratory was made possible through the cooperation of the Portland Cement Association and the Lewis Institute. This laboratory is a striking example of cooperation between an engineering college and a manufacturing industry of international scope.

There are only two ideas governing the policy of this laboratory: the first is, that the real facts regarding concrete and its ingredients shall be found out, with a liberal policy regarding the time required and the expense involved; the second is, that whatever the conclusions may be, they shall be given to the engineering profession for the improvement of the art of making concrete.

These investigations are still being carried on, but many points of vital importance have already been established. As an example, these data warrant the use of considerably higher unit stresses than those in common use today, with a consequent possible reduction in section. Conclusions have also been reached that will enable excellent rsults to be obtained with aggregates heretofore condemned, and also to increase greatly the ability of concrete to resist wear.

These conclusions and many others, are all based on tests running into the thousands and covering long periods of time. Incidentally, the laboratory is equipped for and is making close to 75,000 tests a year, so that there is no lack of facilities for carrying out investigations in the most thorough manner.

General.

The sudy of concrete may be conveniently divided into three phases:

1. The study of the characteristics of the ingredients.
2. The study of the effect of making various combinations of these ingredients.
3. The study of the effect of the various manipulations of the ingredients in making and curing concrete.

It has been the custom to speak of concrete as having three ingredients, cement, fine aggregate and coarse aggregate. The laboratory studies have shown the desirability of classifying the ingredients as cement, aggregate and water, or if it is still desired to maintain the purely arbitrary division of the aggregate into fine and coarse, to add the fourth ingredient, water.

As stated the aggregate has always been divided into two parts, sand, and crushed stone or pebbles. The line of division, purely an arbitrary one, is the quarter-inch screen, the portion passing through this screen being classified as fine aggregate or sand, and the portion retained on this screen being called the coarse aggregate. There is no particular advantage gained by this division but it would be much better to consider the aggregate as a whole, with a proper graduation of the various sizes from the largest to the smallest. It is not intended by this, however, to recommend the use of bank run or crusher run aggregate, as under no conditions should they be used without separating the size and recombining in the proper proportions.

However, until such time as this method of considering the aggregate shall have become of general practice we will consider it as being divided into two parts by the ¼" or No. 4 screen, and will so discuss it.

Fine Aggregate.

It is customary to specify that the fine aggregates shall be clean, sharp and not too fine. It would be better to omit the word "sharp," because rounded particles find their way into place more readily than do sharp ones, and require less water to produce a workable mixture. It is this lowering of the relative quantity of water used that causes the greater compressive strength found in concrete made with smooth, rounded sand. It would be well to insert the word "hard" because that quality is very desirable.

The laboratory studies have brought out two important facts regarding sands. One of these is the great importance of being sure that the material is clean, not only in appearance but in fact. Very often sand which appears to the eye to be clean, contains enough humus or vegetable matter to reduce the strength very considerably.

As an illustration, a clean sand gave a compressive strength at 28 days of 1,900 pounds. This same sand with one-tenth of one per cent of tannic acid added, gave a strength of only 1,400 pounds; in other words, one thousandth part of organic impurities in terms of the weight of the sand reduced the strength of the concrete over 25 per cent. In the investigation of the effect of organic impurities many natural sands were used, but as it was not feasible to secure sands containing a wide variation of organic impurities, tannic acid was used as a substitute for the purpose of making further tests. It was felt that the effect produced by such a material would probably be a measure of the effect produced by other organic impurities which might be present in natural sand.

How can these organic impurities be detected if they cannot be seen by ordinary inspection? By using the colorimetric test for organic impurities which was devised at the laboratory. This test consists of digesting a representative sample of the sand in a dilute solution of sodium hydroxide (caustic soda=NaOH) and observing the resulting color of the liquid.

All that is needed is a 12 oz. prescription bottle and a little 3 per cent solution of caustic soda or sodium hydroxide, both obtainable at any drug store. Put in about 4½ ounces of the sand to be tested, fill up to the 7 ounce mark, after shaking, with the solution of caustic soda, let it stand for 24 hours and observe the liquid on top. If this liquid is clear or light straw colored use the sand; if it runs into the brown color and especially dark brown, reject the sand or wash it thoroughly before using.

The second fact brought out by the laboratory studies is that fine sand behaves exactly the same as coarse sand except in one particular. In order to produce a plastic, workable mixture with fine sand it is necessary to use more water than with a coarse sand. It is the excess of water that reduces the strength of the concrete. In other words if concrete could be mixed with the same quantity of water regardless of the grading of the sand, and a plastic mix obtained in both cases, the same strength would be secured in the concrete.

Coarse Aggregate.

When studying the characteristics of coarse aggregate one conclusion has been

brought out very sharply; namely, that the hardness of the aggregate is a secondary consideration, as compared with other factors, in developing high crushing strength in concrete, and of less importance than ordinarily supposed in developing ability to withstand abrasion. This was very clearly shown in comparative tests made of burnt shale for use in building concrete ships. Samples made with this aggregate compared very favorably with those made with a much harder aggregate. A stone must be very friable indeed if it is not strong enough, when properly combined in concrete, to more than maintain the load likely to be carried by the concrete.

The reason for the high compressive strength often secured where a light, soft aggregate is used, is because the porosity of the aggregate reduces the quantity of water available in the mixture. Here again the relative quantity of the mixing water is the governing factor.

For road surfaces, however, another quality is needed in concrete, namely, resistance to wear or abrasion, and to obtain this the stone must not be too soft. It is not advisable to use a stone with a French coefficient of less than 7 although pavements have given excellent results when made with stone having a coefficient as low as 6.

It is not intended in calling attention to the above results to advise throwing down the bars and allowing the use of any and all stones, irrespective of their hardness or wearing qualities. It is desired, however, to show that many of the safeguards that have been put into specifications in past years are not safeguards at all, and that the effect of following them may be entirely lost through neglect to observe other factors of more vital importance. It is always advisable to use the best materials obtainable; but there have been many cases when the local and easily obtainable material has been rejected, when it could have been used with excellent results by following proper principles in proportioning and protecting the concrete; oftentimes better results would have been obtained than resulted from the use of imported materials and then neglecting the really important factors in making good concrete.

Water.

The remaining ingredient of concrete, water, is in reality of equal importance with the cement in obtaining good concrete, and yet it is often the most carelessly used and most loosely specified of all the ingredients, generally neglected in specifications and frequently not even reported in the published data of concrete tests.

The laboratory has conducted tests of waters sent in from all parts of the country, but definite conclusions have not as yet been published. It is safe to say, however, that waters which are strongly alkaline should not be used, and, owing to the possibility that marsh waters may contain sufficient humus matter to affect seriously the strength of concrete they should be looked upon with suspicion until tested in concrete and found satisfactory. A safe specification is to require that the mixing water shall be potable.

Regarding the temperature of the mixing water, tests have been made, using water ranging in temperature from 32 degrees to 212 degrees F. It was found that the temperature of the mixing water had very little to do with the strength of the concrete. The use of hot water is, however, a valuable aid in removing frost from the aggregate in cold weather, owing to its high specific heat, and may be used without danger of harming the concrete. Hot water tends to hasten the hardening of concrete.

Proportioning.

On studying the second phase of concrete making, there have been brought out at the laboratory, new, and in some ways radical, changes in the past and present practices of proportioning.

These investigations have brought out the following facts, first, that the present method of designing concrete mixtures by using arbitrary volumes is wrong; second, that there is one single proportion which will give the best results with a mixture of given fine and coarse aggregates; third that adding to or reducing the amount of cement is of value only as it affects the relative quantity of water required to make a workable plastic mixture; and fourth, above all, that the water-ratio is the most important element of a concret mix. The water-ratio as used by the laboratory, is the volume of cement in the batch. If 1 cu. ft. of water (7.5 U. S. gals.) is used for each sack of cement, the water-ratio is called 1.00.

The use of more cement in a batch does not produce any beneficial effect except from the fact that a plastic, workable mix can be produced with a lower water-ratio. The reason that a rich mixture gives a higher strength than a leaner one is not that more cement is used, but because the concrete can be mixed with a water-ratio which is relatively lower for the rich mixture than for the lean one. If advantage is not taken of this possibility of reducing the water-ratio the additional cement in the richer mixture is wasted.

Fineness—Modulus.

In studying the results of the tests of many samples of various combinations of aggregates it was evident that there must be some relation between the size and grading of the aggregates and the strength of the concrete. In trying to find this relation Professor Abrams struck upon what is called the "fineness modulus" of aggregates and when this was compared with the strengths of the concrete a direct relation was found to exist.

The fineness modulus is a very simple function of the sieve analysis of the aggregate used for any particular concrete. The aggregate is analyzed with a selected set of U. S. standard square mesh sieves, each one of which has a clear opening double the width of the next smaller. The following sizes are used: 100, 50, 30, 16, 8, 4, ⅜", ¾", 1½" and 3". The precentages (by volume or by weight) of the total aggregates coarser than each sieve are added together, the sum of these percentages is divided by 100, and the result is the fineness modulus. The fineness modulus of any combination of the fine and coarse aggregates may be found in exactly the same manner. Aggregates of many different gradings may have the same fineness modulus; or in other words, aggregates of many different gradings may be used and still secure the same compressive strength in the concrete.

It is not claimed that this method of designing concrete mixtures is the only one that will give the desired results but the laboratory tests prove beyond a doubt that there is a direct relation between the compressive strength of concrete and the factor called the "fineness modulus." This is because the fineness modulus reflects the changes in the water-ratio necessary to produce a given plastic condition in concrete. Accepting this as a fact, it is possible to design a concrete mixture that will give a certain desired compressive strength from many different combinations of aggregates.

It is not possible in a paper of this length to go into the details of the use of this factor for the design of concrete mixtures, but they were published in the Engineering News-Record of April 17, 1919, and a careful

study will enable one to use this factor successfully.

Abrams' Tables of Proportions and Quantities.

In order to make these principles more easily available to engineers, architects, contractors and other users of concrete, Professor Abrams has worked out tables of the proportions and quantities required to produce concrete of compressive strength from 1500 to 4000 lbs. per square inch, at 28 days. All the tests for the determination of the factors in these tables were made of concretes of varying consistencies, formed into cylinders 6" by 12" in size and tested at the end of 28 days.

In conformity with present practice the aggregate is divided in the tables into fine and coarse, and covers combinations of five classes of fine aggregate with eleven classes of coarse aggregate.

Four different consistencies, as indicated by the slumps of the concrete, are used for each combination so that there are 220 different combinations for each strength or 1320 combinations in all.

The quantities shown in the tables are considerably less than those shown in any previously published table due to the fact that they are absolutey net quantities based on laboratory methods of measurements of the aggregates. **For this reason the quantities given should not be used for estimating without the addition of proper allowances for waste and the differences due to the practice of measuring aggregates in a loose condition when making field concrete.**

These allowances should vary for each ingredient and also according to the particular method to be employed in handling the work. For general conditions the following percentages to be added to the table quantities are offered as a suggestion: cement 2%, fine aggregate 10% and coarse aggregate 7½%.

Water Content.

Upon studying the water content, the most radical change from previous ideas on the design of concrete mixtures is found. Based upon thousands of tests it has been established that there is a direct connection between the relative quantity of mixing water used and the strength of the concrete and there is probably no other one factor which has so great an effect upon the strength as the water content.

It has been found that the less water used, as long as the mixture is plastic, and the aggregate is not too coarse for the amount of cement used, the stronger will be the concrete. This does not mean that the amount of water can be reduced too far, nor that, in actual construction, it can be reduced to a point that would give the maximum strength shown in laboratory tests. There is another factor that must be taken into account in construction and that is the workability of the mix. In general terms it can be stated that the lowest water-ratio should be used that will give a workable mix.

Within the range of plastic mixtures, the strength falls off very quickly with the addition of a small amount of water; so much so that in a one bag batch the addition of one pint of water more than is necessary to give a workable mix produces the same loss in strength as if two or three pounds of cement had been left out. Do not think from this that a very lean mix with a small quantity of water will give as strong a concrete as a rich mix with the same quantity of water. This is not true, because it will require a higher water-ratio to produce a workable mix with the lean mixture, thereby causing a loss in strength.

The proper consistency for concrete will vary according to the use to be made of it. If the concrete is to be used for roads a dryer consistency is permissible than for concrete containing reinforcing bars. The use of mechanical tamping and finishing machines in concrete road construction has made it possible to use the dryer consistency economically, but any method which reduces the water content, such as the use of the light roller, will produce beneficial results.

The very wet, sloppy mixtures that are being used in building construction may seem economical from the contractors' point of view but they are certainly extremely wasteful from the designers' and owners' point of view, since in many instances 50 to 60 per cent of the possible strength of the concrete is being thrown away.

It may not be possible to reduce the amount of the water to the ratio necessary to give the maximum strength, but it certainly can be cut down below the amount commonly used, and the additional strength thus gained will be of advantage in the design of concrete structures. The designing engineer figures on a compressive strength of 650 lbs. per sq. in. and expects to get a factor of safety of three, but does not get it with the sloppy mixture often used. By cutting down the water to the proper ratio, a factor of safety of five or six can be secured, or the present allowable unit stresses can be raised.

The exact amount of water required for any particular mixture of aggregates to obtain the greatest strength in the concrete cannot be given, because of the impossibility of determining what amount will produce a workable mix and also because of the varying moisture content of the aggregate. However, a few approximate quantities for different proportions of well graded aggregates up to 1½ in. in size, may be given to form a basis for trial of the particular mixture at hand. A 1:2:4 mixture will require from 6 to 6½ gallons of water per sack of cement, a 1:2:3 mix, 5¾ to 6 gallons, and a 1:1½:3 mix, 5½ to 6 gallons.

Slump Test.

In order to have a simple method for determining the proper consistency in the field the slump test has been devised. At first a metal cylinder 6 inches in diameter and 12 inches high was used, but now a frustrum of a cone 4 in. in diameter at the top and 8 in. at the bottom, and 12 in. high has been adopted as a standard. This cone is filled with the concrete to be tested, which is carefully worked with a pointed metal rod while it is being placed, the form is immediately lifted off, and the settlement or slump measured. The proper slump for a mixture to be used for a concrete road surface is ½ to 1 in.; for mass work, from 1 to 1½ in. and for concrete to be used in structures with reinforcing bars, 2 to 2½ in. In some classes of reinforced concrete work increased plasticity or flowability may be needed. It must only be obtained by adding cement as well as water, in such quantities as to maintain the proper water ratio, otherwise a serious loss in strength will occur.

Manipulation of Ingredients.

In considering the final step—the manipulation of the ingredients during the making of the concrete careful studies have been made of each operation. Included in this phase are the operations of mixing, transporting and placing, and also the curing or protecting of the concrete during the early hardening period, which is one of the most vital operations in the making of good concrete.

The time of mixing is a matter of importance in obtaining good concrete and as this factor largely controls the output of the mixer, it affects the cost of the concrete. Consequently there is an unfortunate tendency to reduce the time of mixing, a practice which cannot be too severely condemned because it results in a material loss in the

strength of the concrete, and a lack of uniformity. Exhaustive tests made on concrete mixed in a batch mixer from 15 seconds to 10 minutes, show a rapid increase in strength for the first minute, and a slightly smaller increase for the second minute, after which the increase in strength is less pronounced as the time of mixing increases. This shows the necessity of mixing the concrete at least 60 seconds after all the ingredients, including the water, have been placed in the drum of the mixer, and not 20 to 40 seconds only, as is often done in road and street construction. There is no question as to the advisability of using a batch meter on the mixer, provided one can be found that cannot be tampered with, in order to avoid controversy over the time of mixing and to insure a full minute mix. When a mixer is manufactured that will not permit discharge until a certain number of revolutions have been made at a certain speed this problem will have been solved.

The revolutions per minute of the mixer within the limits of 12 to 25 R. P. M. have but little effect on the strength of the concrete, so that a sufficiently wide variation for different machines is permitted. In making tests of the effect of R. P. M. on concrete the total time was one minute in all cases, and all materials, including water, were placed in the drum before the time intervals was counted.

The effect of pressure on concrete immediately after moulding is found to be due to the amount of water squeezed out, making a consequent reduction of the water-ratio. Tests were made on concrete of the same proportions, by applying pressure from zero to 500 lbs. per sq. in. The water expelled was carefully collected and measured. It was found the strength increased quite materially with the higher pressures and this increased strength was almost directly proportional to the amount of water squeezed out. It is not surprising to find, then, that the duration of the pressure had no effect whatever on the strength of the concrete. Whether pressure was applied for a few minutes or for several hours the effect produced was exactly the same. It is undoubtdly the squeezing out of the water and consequent reduction of water-ratio that produces the excellent results when the roller method of finishing concrete roads is used.

The time that can be allowed between the time of mixing and the time of placing has not as yet been made the subject of extensive tests at the laboratory. This knowledge will be of value when considered in conjunction with central mixing plants, which are used with success in many places. The time which may elapse between mixing and placing without injury to the concrete is probably governed to a certain extent by the kind of cement used, by the temperature of the mixed concrete, by the nature of the vehicle and the road over which the mixture is hauled. In Illinois a limit of 40 minutes lapsed time is allowed but it is generally believed that the economical haul for the job will be the governing factor rather than the fixing of a time limit.

It is possible that some of the present ideas regarding this factor may be changed by the results of a series of laboratory tests, but until such a time it would not be advisable to allow re-tempering of concrete that has been too long in transit, as the addition of water will no doubt result in a reduction in strength.

Protection

The proper protection of concrete during the early hardening period is a detail of construction that is too often overlooked and many times only indifferently carried out. The effect of proper curing conditions upon the ability of the concrete to withstand abrasion has been very strongly brought out by numerous tests in the laboratory. There is probably no factor in the handling of concrete that so affects its wearing ability, as that of providing proper protection while curing or hardening.

It is true that any and all of the factors that tend to produce strength in concrete also tend to increase its wearing qualities; nevertheless all of our tests show that other factors being the same, the concrete which is properly protected will show much more compressive strength and much less wear than that which has been allowed to dry out too quickly. As an illustration of this, at the end of four months the compressive strength of a concrete of 1.25 consistency was about 1,700 lbs. per sq. in. when it was allowed to dry out in the air unprotected, while exactly the same concrete stored in damp sand for the first 21 days gave a compressive strength of about 4,000 lbs. per sq. in., and a correspondingly less wear in the rattler test.

One of the principal causes of the poor wearing resistance that is sometimes found in concrete floors is due to the practice of allowing them to dry out without proper protection during the hardening period. Concrete floors under roof should be covered and kept moist just as outside roads and pavements are protected. Why throw away one-half of the life of concrete floors by failing to observe this rule and holding back from using them for so short a period?

The essential requirements for proper hardening are warmth and the presence of moisture, especially the latter. The tests show a nearly constant rate of increase in compressive strength and resistance to wear during the first 21 days of proper protection, after which the rate of increase gradually falls off. In deciding on the length of time that a pavement, or other structure, shall be kept covered and moist, it is simply a matter of deciding how much of the potential strength and wear resistance it is desirable to throw away, and reducing the 21 day period by that amount.

There are several methods of protecting concrete pavements and floors during the early hardening period, the most effective of which is the ponding method, and where the grades and other conditions will permit this method to be used, it will give the best results. The protection of concrete structures other than pavements is very often either neglected altogether or at best only half carried out. Many times the leaving on of the forms is considered to be sufficient protection in itself, but this is not so. The forms and all exposed surfaces should be kept thoroughly wet, or at least very moist, continuously for not less than 14 days, and whenever possible for 21 days or more.

Conclusion.

Some of the more important developments resulting from the studies at the laboratory have been outlined herein, with two objects in view: First, to bring out the advisability of designing each concrete mixture to produce a concrete of a certain desired strength, with the particular ingredients available, and, second, to call attention to, and emphasize the important features in the making of good concrete.

In reviewing the methods to be employed in obtaining good concrete there are two points which stand out above all others, and if these are followed more good will have been done than by following all other refinements put together. The first of these is: that the least amount of mixing water shall be used that will give a workable mix, and not one drop more. The second is, that no matter with what care the ingredients are chosen, proportioned, mixed and placed, a considerable portion of the beneficial results

of this care will be nulified unless the concrete is kept moist during the early hardening period.
September, 1921.

Design of Concrete Mixture Without Use of Abrams' Tables.

Four variables must be considered in the design of a concrete mixture as follows:

1. The quantity of the cement (the mix).
2. The plasticity (the slump).
3. The water-cement ratio (the quantity of water).
4. The grading of the aggregate (fineness modulus).

When any two of these variables are fixed it becomes impossible to vary a third without varying the fourth.

Consider the steps required to design without the use of Abrams' Tables of Proportions and Quantities*, a concrete mixture for a desired strength, with known aggregates. Many other problems will come up, but it is believed that this will be the most common. An understanding of the steps required, for the solution of this particular problem will serve in the solution of others.

The term Known aggregates, does not mean only one of each class; there may be several of each available, in which case the problem is worked out for any or all of the combinations desired.

Known—
  Sand (fine aggregate).
  Stone (coarse aggregate).
  Strength (Desired).
To be Determined—
  Plasticity (Governed by construction needs for each job).
  Mixture (Controlled by plasticity, strength and size of aggregate).
  Water-cement ratio (Controlled by desired strength).
  Quantities of ingredients per cubic yard of completed concrete.

Assume for this particular problem a sand graded from 0 to No. 8 sieve and a crushed stone graded from No. 4 sieve to 2 in. and that concrete with a compressive strength of 3000 lb. per sq. in. at 28 days is desired.

Step 1.

Determine upon the plasticity, as indicated by the slump. This is determined by the actual knowledge of the slumps required for concrete in order that it shall be economically workable.

Note: For a given aggregate within the range of plastic mixtures, increased plasticity or workability for the same strength, may be obtained only by adding water and cement in such proportions as to maintain the same water-cement ratio as that giving the desired strength.

(Assume for this problem that the concrete is to be used for road construction with mechanical tamping. This type of construction will permit the economical use of a concrete having a ½ to 1 in. slump).

Step 2.

Determine the real mix and the fineness modulus of such a mix. (The nominal mix of 1:2:4 would have a real mix of about 1:5 or one volume of cement to five volumes of aggregate.) The calculations required for the solution of this step are somewhat involved; in order to simplify the work, four charts (Fig. 1) have been plotted, a separate chart for each range of slumps used in Abrams' Tables. Each of these charts has four variables; strength, maximum size of aggregate, number of volumes of mixed aggregate for one volume of cement (the mix) and the fineness modulus of the mixed aggregate to be used. With any two of the above variables known the remaining two factors can be obtained. Using the chart for ½ to 1 in. slump and the interesection of the 3000 lb. per sq. in. strength contour with the 2 in. maximum size of aggregate contour, the abscissa indicates a fineness modulus of 6.2 and the ordinate a mixture of 1:4.8 which is the **real** mix.

In the explanation under Figure 1, attention is called to the fact that corrections to the values shown on the charts must be made where sands other than 0 to No. 4 are used, therefore for this example, due to using 0 to No. 8 sand, we must add 4% to the amount of cement indicated by the 1:4.8 mix. The mix then becomes 1:4.6.

Step 3.

Make a sieve analysis of each aggregate with set of sieves of U. S. Standard sizes **and determine its fineness modulus,** by adding together the percentages of the total aggregate (preferably by weight) coarser than each sieve, and dividing the sum of these precentages by 100. (Assume for this problem the fineness modulus of the sand to be 2.5 and of the crushed stone, 7.3).

Step 4.

Calculate the ratio of the volume of the fine aggregate the sum of the separate volumes of fine and coarse aggregates. Use the following formula:

$$r = \frac{Mc - M}{Mc - Mf}$$

r=Ratio of volume of fine aggregate to the sum of separate volume of fine and coarse aggregate.

Mc=Fineness modulus of coarse aggregate.
Mf=Fineness modulus of fine aggregate.
M =Fineness modulus of mixed aggregate.

We determined in step 2 that a fineness modulus of 6.2 was required for the assumed conditions. The formula then becomes

$$r = \frac{7.3-6.2}{7.3-2.5} = 0.23$$

In other words 23% of the total aggregate is sand and 77% (1—r=0.77) is broken stone.

Step 5.

Determine the ratio of the volume of mixed aggregate, of the proportions determined, to the volume of the fine and coarse aggregates measured separately. This denotes the yield of aggregate after mixing. This factor can best be dtermined by tests on the aggregates to be used. Find the weight per cubic foot of fine, coarse and mixed (in determined proportions) aggregates. (Note: Aggregates should be room dry and measured in a ½ cu. ft. cylindrical measure with height equal to diameter. Place aggregates in the measure in three layers, rodding each layer 30 times with a pointed ⅝" metal rod, then heap and strike off level with top.) Use the following formula:

$$Ya = \frac{(r \times Wf) + (1-r)\ Wc}{Wm}$$

Ya=Ratio or yield.
r=Ratio of fine aggregate from step No. 4.
Wf=Unit weight of fine aggregate.
Wc=Unit weight of coarse aggregate.
Wm=Unit weight of mixed aggregate.

For our example we will assume the sand to weigh 108 lbs. per cu. ft., crushed stone to weight 105 lbs. per cu. ft., mixed aggregates weighs 123 lbs. per cu. ft., and on substituting we have:

$$Ya = \frac{(0.23 \times 108) + (1-0.23)\ 105}{123} = 0.86$$

or for these conditions 0.23 cu. ft. of sand mixed with 0.77 cu. ft. of coarse aggregae will give a total volume of 0.86 cu. ft. of mixed aggregate.

Step 6.

Determine the Nominal Mix. From Step 2 we find the real mix to be 1:4.6, or 4.6 volumes of mixed aggregate to 1 volume of cement.

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*See Bulletin 9—Structural Materials Research Laboratory, Lewis Institute, Chicago —1921.

Using the ratio Ya found in Step 5 we find the volume of the fine and coarse aggregates measured separately to be $\frac{4.6}{0.86}=5.30$ for each volume of cement.

Therefore:

Volume of sand—0.23 (Step 4) $\times 5.30=1.2$

Volume of crushed stone 0.77 (Step 4) $\times 5.30=4.1$

and the Nominal Mix=1:1.2:4.1.

Step 7.

Determine the quantities of each ingredient per cubic yard of concrete. This is most easily accomplished by using Fig. 2, which is based on actual quantities determined in the laboratory from various mixtures. Using the Real Mix (Step 2) of 1:4.6 we find that 5.73 bags or 1.43 barrels of cement is required for each cubic yard of finished concrete.

Then:

5.73×1.2 (Step 6)=6.9 cu. ft.=0.25 cu. yds. of sand per cu. yd. of concrete.

5.73×4.1 (Step 6)=23.6 cu. ft.=0.87 cu. yds. of stone per cu. yd. of concrete.

Step 8.

Determine the water-cement ratio for the above mixture. There are two methods for this determination, one by the use of Fig. 3, the other by determination in the field from actual concrete mixed in the proper proportions and giving the desired slump. The latter method is recommended, as it will give the amount of water required under field conditions and will automatically take care of the absorption and water content of the aggregates. This quantity can be checked by the use of Fig. 3, remembering that the diagram is based on room dry aggregates and does not take into account either the water absorbed by or the moisture content of the aggregates.

If a further check is desired, the net quantity of water required to produce the desired strength may be calculated from the following equation.

$$X=R\ \frac{(0.35+(0.22-M)\ N)}{42}$$

X=Volume of water required (ratio to volume of cement in a batch; one sack of cement assumed to be 1 cu. ft. and to weigh 94 lb.)

R=Relative consistency desired in the concrete.

1.00 gives slump of ½ to 1 in.

1.10 gives slump of 3 to 4 in.

1.25 gives slump of 6 to 7 in.

1.50 gives slump of 8 to 10 in.

M=Fineness modulus of the mixed aggregates, (See Step 2).

N=The mix (Volume of mixed aggregate to one volume of cement), (See Step 2.)

Therefore in our example:

$$X=1.0\ \frac{(0.35+(0.22-6.2)\ 4.6)}{42}=0.67$$

$=7.48$ (U. S. gal. per cu. ft.) $\times0.67=5.00$ (U.S. gal. of water per sack of cement).

The amount of water to be added because of the absorption and to be subtracted because of the water already contained in the aggregate can, if desired, be determined by actual experiment, but certain approximations are believed to be sufficiently accurate.

R. B. Young in the Engineering News Record of Jan. 1, 1920, states that, "In calculating the water, allowance must be made for moisture contained in the aggregate in its natural state. This has been found to be seldom less than 2% and usually between 3 and 4%. This last is a safe figure to use except directly after a rain, where six or eight per cent moisture should be allowed for and it is believed that these allowances will cover average construction conditions."

The absorption of various aggregates may be determined in accordance with Recommended Practice American Society for Testing Materials 1920 Proceedings Pt. 1 Appendix 1, or average quantities may be assumed to be as follows:

Average sand 2.0% by Volume

Pebbles and crushed limestone 2.0% by Volume.

Porous limestone 8.0% by Volume

Very light and porous aggregate may be as high as 25.0% by Volume.

It may be found that the mixture designed, when used with some aggregates, will be too rough to work easily, and a smoother mixture of the same strength may be desired. The usual custom in this case, is to add sand to the mixture. This, however, will reduce the strength of the concrete unless more cement is added to maintain the same water-cement ratio, as the addition of sand will require more water to give the same plasticity.

A new mixture must be designed as follows: Assume that we wish to increase the sand in our mixture from 0.23 to 0.33 which either judgment or experience tells us will give the proper workability. Our present mix has a fineness modulus of 6.2 and increasing the sand to 0.33 will reduce the stone to 0.67 and change the fineness modulus to 5.7 as determined by following formula:

$$M=Mf\times r+(1-r)\ Mc.$$
$$=2.5\times0.33+(1-0.33)\ 7.2$$
$$=5.7$$

Then from Fig. 1 with a fineness modulus of 5.7 and a strength of 3,000 lb. we find the new mix to be 1:4.4. With this new mix the yield, nominal mix, etc., can be figured in the same manner as outlined above.

For the working out of further problems in concrete mixtures reference is made to Bulletin 1 of the Structural Materials Research Laboratory, also to the article on "Examples of the Application of Abrams' Water-ratio to Proportioning Concrete" by Stanton Walker, published in the Proceedings of the American Concrete Institute Volume XVI, 1920. It is believed that any problem liable to come up in the design of concrete mixtures, may be solved by the intelligent use of the information presented here and in these publications.

Two examples of the successful use of the water-cement ratio theory have already been cited and there follows a few more cases where the use of the theory has effected economy and increased strength in the concrete.

Concrete Road from Universal Cement Co.'s plant at Buffington, Indiana, to Whiting, Indiana.

A fine drift sand and two sizes of blast furnace slag, ⅛ to ⅜-inch and ¾ to 2 inches were used with excellent results. Note that none of the aggregates would have been acceptable under standard specifications.

Grain Elevator in Grand Forks, N. D. C. L. Pillsbury Co.

Pre-Cast Railway Track Paving Slabs in Utah. Salt Lake and Utah R. R.

Concrete Foundation for Power House of Detroit. Edison Co.

Concrete Highways in Maricopa County, Ariz. Maricopa County Highway Commission (Partial application only).

Concrete Highways in Utah. Utah State Highway Commission.

Concrete Highways in Oregon. Oregon State Highway Commission (Partial application only).

Concrete Streets in Athens, Ga. City Engineer.

Dort Motor Company's Plant at Flint, Mich.

No. 735—5/8/22

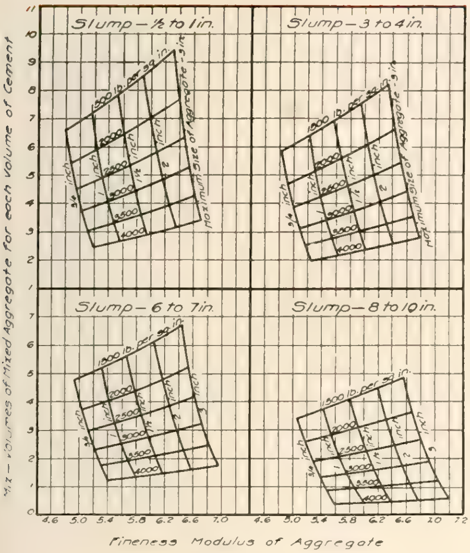


Fig. 1.

RELATION OF SIZE AND GRADING OF AGGREGATE AND QUANTITY OF CEMENT TO STRENGTH OF CONCRETE.

Based on relation between strength and quantity of mixing water shown in Figure 3 and relation between quantity of mixing water and fineness modulus of aggregate shown by equation in Step 8.

The lines sloping upward to the right show the relation between quantity of cement (the mix) and the grading of aggregate (the fineness modulus) for a given strength and consistency.

The lines sloping upward to the left give the maximum value of fineness modulus which may be used for an aggregate of a given maximum size for different mixtures to obtain a workable concrete. (For method of determining maximum size, see explanation of tables in Bulletin 9—Structural Materials Research Laboratory, Lewis Institute, Chicago.)

Values from chart should be used only for aggregate having 0—No. 4 sand as a fine aggregate. The following quantities of cement should be added to the values found on the diagrams for sands of different size:

Size of Sand	Cement added to Correct for Size of Fine Aggregate per cent
0—28	12
0—14	8
0—8	4
0—4	0
0—⅜	—4

Fig. 2.

CEMENT FOR ONE CUBIC YARD OF FINISHED CONCRETE.

Note that values are net quantities with no allowance for waste. The curve is based on average values for aggregate of sizes shown in the tables in Bulletin 9—Structural Materials Research Laboratory, Lewis Institute, Chicago.

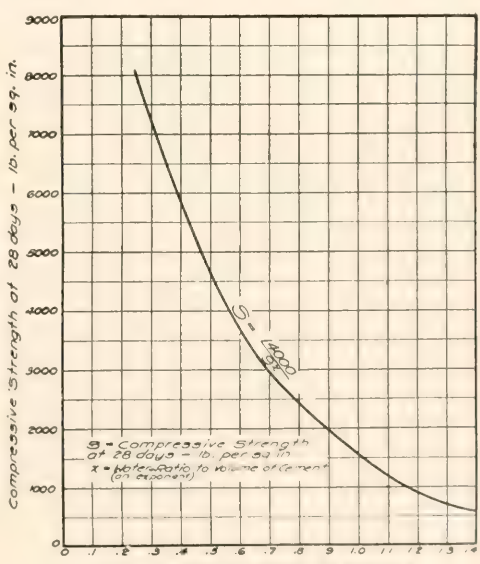


Fig. 3.

EFFECT OF QUANTITY OF MIXING WATER ON THE STRENGTH OF CONCRETE

The curve is based on average value from nine different series of tests made over a period of four years. Tests made on 6 by 12-inch cylinders at 28 days. This curve was used in the construction of diagrams in Figure 1.

STANDARD SPECIFICATIONS FOR BILLET-STEEL CONCRETE REINFORCEMENT BARS

Serial Designation: A 15—14.

The specifications for this material are issued under the fixed designation A 15; the final number indicates the year of original issue, or in the case of revision, the year of last revision.

Adopted, 1911; Revised, 1912, 1913, 1914.

(1) (a) These specifications cover three classes of billet-steel concrete reinforcement bars, namely: plain, deformed, and cold-twisted.

(b) Plain and deformed bars are of three grades, namely: structural-steel, intermediate and hard.

2. (a) The structural-steel grade shall be used unless otherwise specified.

(b) If desired, cold-twisted bars may be purchased on the basis of tests of the hot-rolled bars before twisting, in which case such tests shall govern and shall conform to the requirements specified for plain bars of structural-steel grade.

I. Manufacture.

3. (a) The steel may be made by the Bessemer or the open-hearth process.

(b) The bars shall be rolled from new billets. No rerolled material will be accepted.

4. Cold-twisted bars shall be twisted cold with one complete twist in a length not over 12 times the thickness of the bar.

II. Chemical Properties and Tests.

5. The steel shall conform to the following requirements as to chemical composition:

Phosphorus
Bessemer.......not over 0.10 per cent
Open-hearth.... " " 0.05 "

6. An analysis to determine the percentages of carbon, manganese, phosphorus and sulfur, shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in Section 5.

7. Analysis may be made by the purchaser from finished bars representing each melt of open-hearth steel, and each melt, or lot of ten tons, of Bessemer steel, in which case an excess of 25 per cent above the requirements specified in Section 5 shall be allowed.

III. Physical Properties and Tests.

8. (a) The bars shall conform to the following requirements as to tensile properties:

Tensile Properties.

Properties Considered.	Plain Bars. Structural Steel Grade.	Plain Bars. Intermediate Grade.	Plain Bars. Hard Grade.	Deformed Bars. Structural Steel Grade.	Deformed Bars. Intermediate Grade.	Deformed Bars. Hard Grade.	Cold-twisted Bars.
Tensile strength, lb. per sq. in...	55,000 to 70,000	70,000 to 85,000	80,000 min.	55,000 to 70,000	70,000 to 85,000	80,000 min.	Recorded only.
Yield point, min., lb. per sq. in....	33,000	40,000	50,000	33,000	40,000	50,000	55,000
Elongation in 8 in. min., per cent..	1,400,000* / Tens. str.	1,300,000* / Tens. str.	1,200,000* / Tens.str.	1,250,000* / Tens. str.	1,125,000* / Tens. str.	1,000,000* / Tens. str.	5

(b) The yield point shall be determined by the drop of the beam of the testing machine.

9. (a) For plain and deformed bars over ¾ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each increase of ⅛ in. in thickness or diameter above ¾ in.

(b) For plain and deformed bars under 7/16 in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 8 (a) shall be made for each decrease of 1/16 in. in thickness or diameter below 7/16 in.

10. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend-Test Requirements.

Thickness or Diameter of Bar.	Plain Bars. Structural-Steel Grade.	Plain Bars. Intermediate Grade.	Plain Bars. Hard Grade.	Deformed Bars. Structural-Steel Grade.	Deformed Bars. Intermediate Grade.	Deformed Bars. Hard Grade.	Cold-twisted Bars.
Under ¾ in....	180 deg. d=t	180 deg. d=2t	180 deg. d=3t	180 deg. d=t	180 deg. d=3t	180 deg. d=4t	180 deg. d=2t
¾ in. or over...	180 deg. d=t	90 deg. d=2t	90 deg. d=3t	90 deg. d=2t	90 deg. d=3t	90 deg. d=4t	180 deg. d=3t

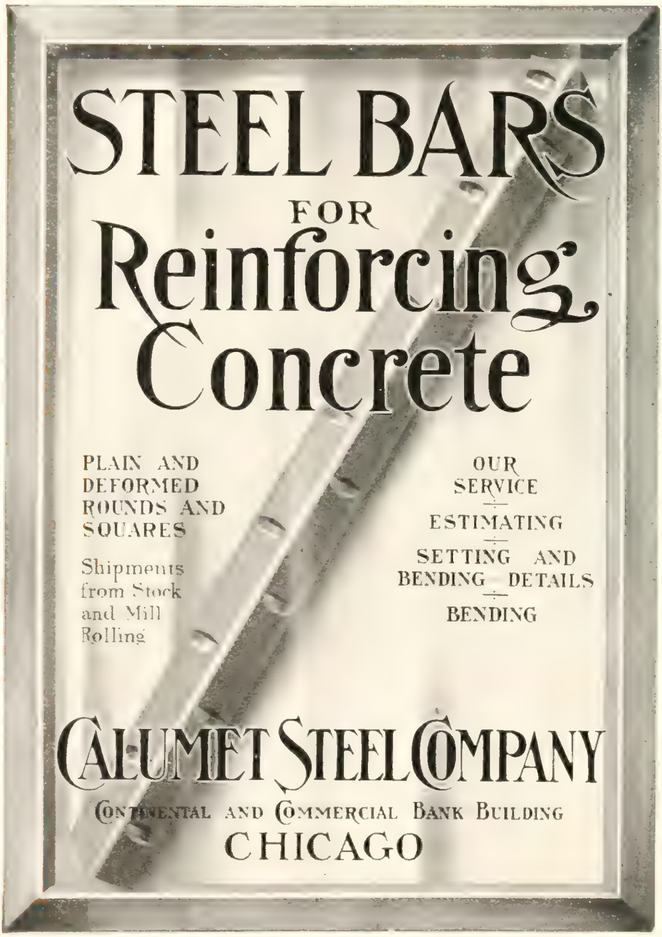
Explanatory Note: d=the diameter of pin about which the specimen is bent; t=the thickness or diameter of the specimen.

11. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled; except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for cold-twisted bars shall be taken from the finished bars, without further treatment; except as specified in Section 2 (b).

12. (a) One tension and one bend test shall be made from each melt of open-hearth steel, and from each melt, or lot of ten tons, of Bessemer steel; except that if material from one melt differs ⅜ in. or more in thickness or diameter, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

*See Section 9.


STEEL BARS
FOR
Reinforcing
Concrete
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Shipments from Stock and Mill Rolling
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ESTIMATING
SETTING AND BENDING DETAILS
BENDING
CALUMET STEEL COMPANY
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CHICAGO

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 8 (a) and any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

IV. Permissible Variations in Weight.

13. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.

V. Finish.

14. The finished bars shall be free from injurious defects and shall have a workmanlike finish.

VI. Inspection and Rejection.

15. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the bars ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bars are being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

16. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 7 shall be reported within five working days from the receipt of samples.

(b) Bars which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

17. Samples tested in accordance with Section 7, which represent rejected bars, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

STANDARD SPECIFICATIONS FOR RAIL STEEL CONCRETE REINFORCEMENT BARS

As Adopted by American Society for Testing Materials, Philadelphia, Pa., U. S. A., 1913.

Classes.

1. These specifications cover three classes of rail-steel concrete reinforcement bars, namely: plain, deformed, and hot-twisted.

I. MANUFACTURE.

Process.

2. The bars shall be rolled from standard section Tee rails.

Hot-twisted Bars.

3. Hot-twisted bars shall have one complete twist in a length not over 12 times the thickness of the bar.

II. PHYSICAL PROPERTIES AND TESTS.

4. (a) The bars shall conform to the following minimum requirements as to tensile properties:

Properties Considered.	Plain Bars.	Deformed and Hot-twisted bars.
Tensile strength, lb. per sq. in....	80,000	80,000
Yield point, lb. per sq. in...........	50,000	50,000
Elongation in 8 in., per cent*.......	1,200,000 Tens. str.	1,000,000 Tens. str.

* See Section 5.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

Modification in Elongation.

5. (a) For bars over ¾ in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 4 (a) shall be made for each increase of ⅛ in. in thickness or diameter above ¾ in.

(b) for bars under 7-16 in. in thickness or diameter, a deduction of 1 from the percentages of elongation specified in Section 4 (a) shall be made for each decrease of 1-16 in. in thickness or diameter below 7-16 in.

Bend Tests.

6. The test specimen shall bend cold around a pin without cracking on the outside of the bent portion, as follows:

Bend Test Requirements.

Thickness or Diameter of Bar.	Plain Bars.	Deformed and Hot-twisted bars.
Under ¾ in......	180 deg. d = 3 t	180 deg. d = 4 t
¾ in. or over.....	90 deg. d = 3 t	90 deg. d = 4 t

Explanatory Note: d = the diameter of pin about which the specimen is bent; t = the thickness or diameter of the specimen.

Test Specimens.

7. (a) Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled; except that the specimens for deformed bars may be machined for a length of at least 9 in., if deemed necessary by the manufacturer to obtain uniform cross-section.

(b) Tension and bend test specimens for hot-twisted bars shall be taken from the finished bars, without further treatment.

Number of Tests.

8. (a) One tension and one bend test shall be made from each lot of ten tons or less of each size of bar rolled from rails varying not more than 10 lb. per yd. in nominal weight.

(b) If any test specimen shows defective machining or develops flaws, or if a tension test specimen breaks outside the middle third of the gage length, it may be discarded and another specimen substituted.

III. PERMISSIBLE VARIATIONS IN WEIGHT.

Permissible Variations.

9. The weight of any lot of bars shall not vary more than 5 per cent from the theoretical weight of that lot.

RULES OF MEASUREMENT FOR EXAVACATION AND CONCRETE WORK

The following rules have been carefully studied and analyzed by a joint committee consisting of five (5) members of the Chicago Architects Business Association, five (5) members of the Western Society of Engineers, and five (5) members of the Contractors' and Masons' Association of Chicago.

If any new rules or new applications of old rules should be found in the following, we can only say for their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

EXCAVATION OF CELLARS AND BASEMENTS.

1. Excavation to be measured and computed by the actual amount of material displaced. If unit price is based upon loose measurement add forty (40%) per cent to actual bank measurement, except if consisting of sand and gravel, when only twenty (20%) per cent will be added. If rehandling becomes necessary, same to be done at a special price agreed upon in addition to the above.

EXCAVATION OF TRENCHES AND PITS.

2. Excavation of trenches, pier holes, or pits when more than 3′ wide to be computed on actual contents when less than five (5′) ft. deep.

When less than three feet wide excavation of trenches, pier holes, or pits to be computed on actual contents if less than two (2′) feet deep.

If more than two feet (2′) deep compute contents of trench on base of three foot (3′) width, even though same is narrower.

If less than two (2′) feet in depth estimate actual width.

For pits or pier holes more than two (2′) feet deep and less than twelve (12) square feet in area estimate area of same on base of twelve (12) square feet multiplied by depth of same down to five (5′) foot, and if more than five (5′) feet deep estimate on same basis as given below for additional depth of trenches, with the same percentages of increases added.

Add 75% to actual contents of excavation of trenches, pier holes, or pits for depth between five (5′) ft. to ten (10′) ft.

Add 150% to actual contents of excavation of trenches, pier-holes, or pits, for depth between ten (10′) ft. and fifteen (15′) feet.

Add 225% to actual contents of excavation of trenches, pier holes, or pits for depth between fifteen (15′) feet and twenty(20′) feet.

Add 300% to actual contents of excavation of trenches, pier holes, or pits for depth between twenty (20′) feet and twenty-five (25′) feet.

Add 375% to actual contents of excavation of trenches, pier holes, or pits between twenty-five (25′) feet and thirty (30′) feet in depth.

Add 450% to actual contents of excavation of trenches, pier holes, or pits between thirty (30′) feet and thirty-five (35′) feet in depth, and so on, adding 75% accumulative for every five (5′) feet additional depth.

BACK FILLING AND GRADING.

3. Soil required for back filling or grading to be measured by computing from cross-sectioning cubic contents of area to be filled or graded.

SHEET PILING.

4. Sheet piling and lagging to be estimated per thousand feet of lumber required. Kind of lumber to be specified.

SHORING OF EARTH BANKS.

5. Shoring of earth banks to be done at unit price, per square foot of shored surface of bank.

DRAINING.

6. Pumping or bailing when required to be done at special price, in addition to excavation unit price, as the excavation rules are based on dry work: this, however, does not apply to rain or storm water.

CONCRETE FOUNDATIONS.

7. Foundations for walls to be measured actual contents when made with square and level off-sets.

Footings with sloping or beveled off-sets less than 30% from the horizontal multiply area of base by greatest height of footing. This applies to piers also, except when courses in pier foundations are less than twelve (12′) feet in area, when one (1) cubic foot will be added for each corner for every foot in height of such course.

8. Foundations for all projections such as chimney breasts, pilasters, buttresses, or flues connected with walls to be measured actual contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

9. Recesses and slots in foundations to be measured solid and in addition thereto allow two (2) cubic feet for every foot in height or length.

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References:

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10. Arches in foundation. Multiply length of chord at spring of arch by height from chord to extrados by thickness of arch, and add to the wall measurement. Height of arching equal to thickness of wall.

CIRCULAR OR POLYGON FOUNDATIONS.

11. Circular or polygon foundations to be figured at double actual contents.

EXTERNAL, DIVISION AND INTERIOR CONCRETE WALLS.

12. For walls fourteen (14) feet or less in height, twenty-four (24) inches or more in thickness, use the actual thickness as basis in computing the volume. For walls less than twenty-four (24) inches in thickness, add one-half the difference between the actual thickness and twenty-four (24) inches in computing the volume. If walls are more than fourteen (14) feet in height between floors add to cubic contents fifteen (15) per cent for every additional four (4) feet in height, on accumulative scale, as given for trench excavation.

CIRCULAR WALLS.

13. For circular walls of radius sufficiently large to obviate the necessity of using specially prepared lumber for forms, add one-fifth (1-5) of length to girt of wall, and figure cubic contents on the same basis as prescribed for External and Division Walls, Paragraph 12.

BATTERED WALLS.

14. For battered, or sloping walls estimate contents on same basis as for external and division walls, and add one-half (½) of contents of wedge, or batter to same when narrower on top than twenty-four (24″) inches. See Paragraphs 12 and 17.

INTERSECTION OF WALLS.

Intersection of division walls twenty-four (24) inches thick or less (bonded together in any manner not abutting) to be measured as slot or recess. When thicker add (1) one foot to length of wall for every intersection when measuring.

RETAINING WALLS.

15. In retaining walls reinforced with beams, columns, or girders figure concrete casing a minimum thickness of twelve (12″) inches from outside edge of steel on side next to earth bank and six (6″) inches from outside edge of steel on opposite side—i. e. compute wall one foot, six inches (1′-6″) thicker than width of steel.

For all other retaining walls compute on same basis as for external or internal walls, paragraphs twelve (12) and seventeen (17.)

No deduction in cubic contents of concrete to be made for metal imbedded in same.

HOLLOW WALLS.

16. Hollow walls to be at special rates.

CORNERS.

17. For each corner of wall more or less than ninety (90) degrees add one foot, six inches (1′-6″) to girt length of walls in measuring.

The term corner is used for salient angles of walls, and angle for re-entering angles.

PILASTERS, ETC.

18. All plain projections, such as chimney breasts, piers connected with walls and pilasters to be measured actual contents contained therein, and one (1) cubic foot added for each corner for every foot in height.

PIERS.

19. Independent plain square piers to be measured by the same rule, i. e. add one cubic foot for each corner for every foot in height. For plain polygon or round piers, add four (4) cubic feet for each foot in height.

RECESSES.

20. Recesses and slots to be measured solid and in addition thereto allow two (2) cubic feet for every foot in height or length.

ARCHES.

21. In Vaults: multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add same to wall measurement, as called for in paragraph ten (10).

In sewers and tunnel arches: multiply length of extrados by thickness of arch.

OPENINGS WITH FRAMES BUILT IN.

22. Deduct contents of windows, doors and other openings, measuring from jamb to jamb and from top of sill to spring of arch, and add two (2) feet of wall for each jamb for every foot in height of opening when plank frames are used; if box frames are used add four (4) feet of wall for each jamb for every foot in height.

OPENINGS WITHOUT FRAMES.

23. Deduct contents of openings, same to be measured from top of sill to spring of arch and shortest distance between concrete jambs for width, and add for each jamb two (2) feet of wall for every foot in height of opening.

Circular, oval or other special shaped openings to be figured at special price.

CHIMNEY BREASTS, FLUES AND PILASTERS.

24. All flues and hollows in chimneys or walls less than two (2) feet in area, figure solid and add two (2) cubic feet for every foot in height. All flues and hollows in chimneys or walls from two (2) feet to four (4) feet in area to be measured solid. When larger, deduct one-half (½) of contents of flue.

Detached portions of chimneys in buildings and plain chimney tops above roof to be measured solid, and one (1) cubic foot to be added for each corner for every foot in height.

DETACHED STACKS.

25. Detached chimney stacks to be figured at special rates.

TRIMMINGS.

26. No deductions allowed for omissions of concrete for cut-stone, terra cotta or other trimmings, bond blocks, timber, joists or lintels.

All ornamental or moulded work in cornices, gutters, belt or sill courses, etc., to be figured at special rates.

CUTTING AND PATCHING.

27. Cutting and patching of joists, girders, or other holes, slots, panels, recesses, etc., to be paid for on basis of time and material required.

TOOTHING.

28. When ordered by the Owner, Architect, Engineer, or the Superintendent in charge of the work, to rack or block in consequence of delay of delivery of iron, steel, stone, terra cotta, or other material, that concrete work may connect with such rack-

ing or blocking shall be measured as extra work, as follows: Increase girt length of such line by one-half (½) and multiply by thickness of wall.

CONCRETE FLOORS ON SOIL AND TILE ARCHES.

29. Floors to be measured by the superficial surface between outside walls of building. No deduction to be made for floor sleepers, conduits, pipes, drains, division or partition walls. No deduction to be made for any piers, columns, chimney breasts, pilasters or other projections of walls of ten (10′) feet or less in area.

CAISSONS.

30. Owing to grillage in caissons being left at different heights in same building, unit price for caissons will be computed on excavated contents, including necessary wood-lagging and rings for same. Cubic contents of excavation of caissons to be computed from top of first set of lagging to bottom of caissons and from outside to outside of lagging. If steel or other special casing is required same to be paid for additional, at special unit price per pound.

BELLS.

31. Area of bottom of bell to be multiplied by height of bell to neck for cubic contents.

32. For Caissons 7′ 0″ or more in diameter estimate actual contents from outside to outside of lagging.

For Caissons from seven to six ft. six inches inclusive add 5% to actual contents.

For Caissons under six feet six inches to six feet inclusive, add 15% to actual contents.

For Caissons under six feet to five feet six inches inclusive, add 25% to actual contents.

For Caissons under five feet six inches to five feet inclusive, add 35% to actual contents.

For Caissons under five feet add fifty per cent (50%) to actual contents.

33a. If compressed air is required, same to be paid for in addition to the above.

33. If rings are ordered left in caissons, same to be paid for additional at unit price per pound.

34. Pumping and bulkheading to be paid for at additional price.

35. No deduction to be made for cubic contents of metal imbedded in concrete.

CONCRETE FILLING IN CAISSONS.

36. Concrete for filling of caissons to be computed on actual contents per cubic foot of concrete, but no deduction to be made for any metal imbedded in same.

REINFORCED CONCRETE WORK.

37. Reinforced Walls:

Compute concrete on same basis as specified in Sections 12 and 17, for external and division walls, and add to same cost of reinforcing metal put in place. If through changes or revisions cutting of reinforcing metal delivered or ordered becomes necessary, estimate the full length of such bars or metal fabric, and add to same cost of cutting and fitting required. Reinforcing metal to be computed on unit price per pound or square foot. No deductions to be made in estimating cubic contents of concrete for any metal imbedded in same, such as wire netting, expanded metal, bars, beams, columns, etc.

COLUMNS.

38. Measuring of plain uniform size columns to be covered by the foregoing paragraph 19 relating to piers.

39. Capitals, caps, brackets, panels, mouldings or other ornamental or moulded work to be figured special rate.

GIRDERS, FLOOR BEAMS OR OTHER DROP PROJECTIONS BELOW FLOOR SLAB.

40. For projections named in this paragraph add for each corner and angle to cubic contents one (1) cubic foot for each foot in length. For each chamfered or rounded corner or angle add one-half (½) cubic foot for each foot in length in addition to the above.

FLOOR SLABS.

41. Floor and roof slabs to be estimated on same basis as called for in paragraph 29 for floors on soil, and at a minimum thickness of six (6) inches. Less than six (6) inches in thickness will be computed as six (6) inches.

OPENINGS.

42. No deductions to be made in floor area for openings of less than twenty (20) square feet. For larger openings after deducting full area of opening, add one (1) superficial foot to floor area for each foot in length of girt of opening, and one (1) CUBIC FOOT extra for each corner or angle

DEPRESSIONS.

43. For pits, baskets or other depressions in floor, add on superficial foot to the area of walls and floor of same for each foot in length of each corner and angle.

SETTING OF FACIAS, FRAMES, PIPES, SLEEVES, BOLTS, RODS, CLAMPS, ETC.

44. Setting of facias, frames, pipes, sleeves, bolts, rods, clamps, etc., imbedded in concrete to be paid for additional at special price.

FLOOR BASE AND COVES.

45. Floor base and coves to be estimated at special price per lineal ft. with one foot added to length of same for each corner and angle. For base or cove around round columns estimate three (3) times girt of column and for square or polygon columns add one foot for each corner to girt of same.

46. Concrete stairs to be estimated square foot area of face of treads and risers. Stair-landings and platforms between floors to be same unit price per foot as stairs.

47. Curbs and roofs or skylights to be estimated on same basis as called for in sections 40 and 41 except that quantities for same shall be doubled.

48. Sidewalks laid on soil or tile and brick arches, to be estimated as floor-slab section 29 with special unit price.

Sidewalks reinforced to be estimated same as called for in sections 40 and 41 with special unit price.

Curbs to be estimated per lineal foot at special unit price.

Driveways to be estimated square foot area at special unit price. (Signed)

H. B. Wheelock,	W. S. Shields,
Thomas H. Mullay,	B. E. Grant,
Joseph C. Lewellyn,	A. Lanquist,
L. G. Hallberg,	Addison E. Wells,
Arthur Woltersdorf,	E. F. Pierce,
Joachim G. Giaver,	Henry Ericsson,
Louis E. Ritter	J. W. Snyder.
Alexander C. Warren,	

STANDARD FORM OF CUT STONE SPECIFICATION

For Indiana Oolitic Limestone

INDIANA LIMESTONE OR BEDFORD STONE

Indiana Limestone constitutes one of the great natural resources of the country. The industry has grown to such an extent that it is in no sense local or sectional but national in character and since this stone is so extensively specified by Architects, these specifications and notes regarding its use have been included.

The Indiana Limestone Quarrymen's Association offers free technical service to Architects, who are cordially requested to make use of the Service Department and Bureaus of the Association as a source of reliable and impartial information regarding the products of the industry, their proper and economical use and for assistance on any problems pertaining to Indiana limestone and its employment in building construction.

Chicago Branch Bureau of Service Department at Building Material Exhibit—6th Floor, 15 East Van Buren Street. Service only, no sales, no reports to trade. Inquiries and consultations strictly confidential.

Notes on Standard Specifications for Indiana Limestone

Research work and investigations bearing on the subject of Specification requirements are being conducted by the Technical Division of this Association and it is the intention to revise this standard specification from time to time, in order to keep it up to date with the developments of this research work, or as may be found advisable to improve it and have it conform with the best modern engineering practice as applied to Building Construction.

Classification:

The Indiana Limestone Quarrymen's Association classifies the Industry's product by color-tone and texture as follows and recommends the use of these terms to indicate the desired grades of stone which its members produce:

"Regular Grades"	Standard Buff stock.
Select Gray stock.	"Special Grades"
Standard Gray stock.	Rustic Buff.
Select Variegated stock.	Special Hard Buff
	Special Hard Gray.
Standard Variegated stock.	Indiana Travertine, sawed either with or across the grain.
Select Buff stock.	

Other specialties, ranging in color tone from very light, almost a cream white, to distinctly dark, are also usually available, samples of which will be furnished by the Association upon request. A general description of the various grades and recommendation as to their selection and employment is given below.

Architects should remember that the Association Classification of the Industry's product is for their direct benefit and the protection of their clients in the specifying of Indiana Limestone. The well known Oolitic Limestone of Indiana formerly called Bedford Stone is commercially available only in Lawrence and Monroe Counties and the Architect should protect both his client and himself against substitutes. All of the long established and proven quarries from which this dependable stone has been produced for generations are located within these two counties.

The recommendations and standard practice of this Association are an effort to improve and standardize current usage and to assure the proper and economical use of its members' product in modern building construction. The standard practice of this Association is rapidly becoming universally recognized.

"Standard" stock is the standard product of the quarries constituting the bulk of the total output. It is thoroughly sound stone having a range of variation in color shades and texture not found in "Select" but which by reason of the nature of the deposit are confined within limits that make it impossible to determine at a distance of a few feet whether it is "Standard" or "Select" stock. Stone of the Standard Gray, Buff or Variegated classification is generally used for all purposes in the regular run of work.

"Select" or No. 1 stock is much more uniform in color and texture than is required for all ordinary purposes in general building construction. Select stock is recommended for entrance work and those portions of a building within ready range of vision, for carving, sculpture, certain interior work and other special uses. It is considered an unnecessary, if not wasteful, expense to specify Select stock for the entire exterior of the average building, or to use this grade of stone for heavy cornices and other work having fairly large scale detail placed well above the range of close inspection, as the difference in texture between "select" and "Standard" rock in such position cannot be noted.

On the other hand, it is not proper to mix Standard and Select stock or Standard and a coarser variety in any well defined architectural member such as Grade or Base Course, Belt Course or Cornice, etc. and Architects are justified in insisting that the Cut Stone Contractor use some judgment in selecting the stock of any grade for the several portions of the work.

"Rustic" stock, which is only available in Buff color, has more variation in color-tone and texture, having a wider range of granular formation than either Standard or Select stock. This grade is particularly suitable for the sawed ashlar facing of walls and for that purpose may be combined with trim of either Standard or Select stock. "Rustic" is not generally to be recommended to take the place of Standard; or for positions in the building on which there is much cutting and moulded work, on account of its texture and hardness with resultant increase in cost of cutting, but may be used to advantage for heavy cornices and other boldly detailed simple moulded work.

"Special Hard" Gray and "Special Hard" Buff are grades that are specially adapted for base or grade courses, steps and platforms, buttresses, floor tiling, terrace paving, or any position in building subject to abrasion and constant wear under foot traffic; for which purposes these grades are recommended.

While Indiana Travertine is nominally a waste product of the quarries, constituting only a very small percentage of the total output, the amount of selection required and extra cost of working up this very distinctive material will generally make the price somewhat higher than for any of the regular grades. This stone is recommended chiefly for sawed ashlar and for sawed Facing or Ashlar slabs for interior work. When moulded, the detail should be kept plain and broad in treatment.

Both the Rustic Buff and the Travertine may be used—sawed either with or across the grain.

CUT INDIANA LIMESTONE.

1. Work Included:

The work under this contract shall include all labor and material for the furnishing of cut stone work in accordance with the drawings and as hereinafter specified.

2. Description of Stone.

All Limestone specified or shown on drawings shall be (state grade desired)

Select Gray,
(Often referred to as No. 1 Gray)
Standard Gray,
Select Buff,
(Often referred to as No. 1 Buff)
Standard Buff,
Select Variegated,
[Often referred to as No. 1 Variegated]

Standard Variegated.

Indiana Oolitic Limestone building stock, free from all defects that would materially impair its strength, durability or appearance, and within the range of variation of color and texture represented by two samples approved by the Architect.

Specially graded stone acceptable as to hardness and color as per samples to be submitted shall be employed where indicated on drawings, for
and all other positions exposed to direct wear.

Wherever the terms "Indiana Limestone" or "Limestone" occur in this specification, they specifically refer to and shall imply "Indiana Oolitic Limestone" quarried in Lawrence or Monroe County.

3. Samples.

The contractor shall submit to the Architect, two samples which shall be typical of the extremes which the contractor proposes to furnish. Samples to be about 3¾" wide by 8½" long by about 1" thick, produced so that the large faces shall show across the grain of the stone, the finish specified to be indicated on the large face and at least two of the edges to be rock face. Similar samples shall be provided when Select stock or specially graded hard stone is specified for certain positions in the building.

These samples shall be labled or otherwise clearly marked with the name of the contractor submitting same, and the name of the limestone, with the statement: "Samples of Indiana Limestone to be furnished for the ( ) Building."

4. Standard Practice.

Insofar as these specifications pertain to the practice set out for the proper use of Indiana Oolitic Limestone, the standards established by the Indiana Limestone Quarrymen's Association of Bedford, Indiana, are to govern. Bidders not familiar with these standards are cautioned to inform themselves regarding them.

The Architect reserves the right to approve the sub-contractor for Cut Stone before this portion of the work is awarded.

5. Cutting & Setting Drawings.

The cut stone contractor shall prepare and submit to the Architect for his approval complete cutting and setting drawings in triplicate for all of the Indiana Limestone work under this contract. Such drawings shall show in detail sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details.

Moulded or projecting courses, unless otherwise shown, shall have not less than four-sevenths (4/7) of their cubic contents inside the face of wall and all projecting stones, except where otherwise shown or specially anchored to the structure, and so provided for by details on setting drawings, shall have beds in the wall at least 1" greater in depth than their maximum projection. There shall be "through" or bond stones wherever indicated on approved stone details.

These drawings shall be based upon and follow the drawings and full size details prepared by the Architect, except where it is agreed in writing that changes be made. No departure from the Architect's drawings shall be indicated on setting drawings submitted to the Architect for approval unless this departure is specifically called to the Architect's attention by a letter of explanation accompanying same. Each stone indicated on these drawings shall bear a corresponding number marked on the back or bed with a non-staining paint.

Provisions for the proper anchoring and dowelling or clamping of work in keeping with standard practices, also for the support of same by shelf angles and loose steel, etc., when required, shall be clearly indicated on the setting drawings.

6. Details for Lintels, Etc.

Lintels and Architraves or other members spanning openings, where supporting a superimposed load or only their own weight, shall be of the proportions and sectional area that will provide an ample factor of safety based on the average ultimate breaking strength of the stone.

7. Carving & Models.

All carving shall be done under this contract by skilled carvers, in a correct and artistic manner, in strict accord with the spirit and intent of the Architect's sketches, or from plaster models prepared or approved by the Architect.

8. Cutting.

All stone shall be cut accurately to shape and dimensions and full to the square and with jointing as shown on approved drawings. All exposed faces shall be cut true and out of the wind. Beds and all joints shall be dressed straight and at right angles to the face unless otherwise shown and except where otherwise shown or noted on drawings joints shall have a uniform thickness of ¼".

Patching or hiding of defects will not be permitted and Lewis Holes shall not be made on exposed surfaces.

Washes shall be as deep as practical and drips of sufficient width and depth to shed water shall be provided on all projecting stone and courses. In the absence of specific indication otherwise all coping, caps and sills shall overhang the work below not less than 1½" and shall have ¾" drips.

Reglets for flashing, etc., shall be cut in the stone where so indicated on the drawings.

Moulded work shall be carefully executed from full size details, supplied by the Architect. All arrises to be sharp and true.

All columns shall be accurately cut with the entasis as shown on drawings. All pilasters unless indicated otherwise to be cut straight without entasis or taper.

9. Back Checking & Fitting to Structural Frame.

Stone coming in connection with structural work shall be back checked as indicated on the general drawings. Stones resting on structural work shall have beds shaped to fit the supports.

Where stone facing adjoins steel columns and spandrel girders, the depth of stone shall be such that it will allow not less than three inches between extreme edge of metal and the back of the stone.

10. Finish.

The finish on exposed surfaces generally shall be smooth, machine dressed, showing no tool marks.

11. Lewis Holes & Cutting for Dowels, Anchors, Clamps, Etc.

Lewis Holes shall be cut in all stones weighing more than 100 pounds. No Lewis or other holes shall come closer than 2 inches to the exposed face of the stone.

Holes and sinkages shall be cut in stones for all anchors, clamps, dowels, etc., called for under this specification and indicated on the cutting and setting drawings.

12. Loading & Shipment.

The Cut Indiana Limestone shall be carefully packed for rail or wagon transportation with exercise of all customary practical and reasonable precautions against damage in transit.

All cut stone under this contract shall be delivered promptly as ordered and in the sequence in which it is to be set.

13. Field Cutting.

(Specify in detail any field cutting that will be required.)

SETTING CUT STONE.

14. Work Included.

Contractor shall refer to the preceding specification for cut Indiana Limestone for more detailed information regarding the cut stone that is to be set under this contract; also refer to "General Masonry", "Sheet Metal Work", "Roofing" and "Carpentry" specifications for reference to work that must be executed in conjunction with this work.

15. Delivery & Storage.

All Indiana Limestone delivered f. o. b. cars at destination under another contract shall be carefully unloaded and delivered to the building site.

Wagon or truck haul shall be handled throughout by competent workmen and by such methods as will guard against soiling, mutilation or chipping in transit to and upon delivery at the building site.

The stone shall be stored at the building site, for whatever period, on planking set so that stone will rest entirely clear of the ground and be protected by proper means from damage to arrises and from contact with anything which would result in the accumulation of dirt, dust, soot, mud, grease or other staining or disfiguring elements. During extended periods of storage at building site, the stone to be covered with tarpaulin, stout non-staining paper or boards.

16. Setting Mortar.

All Indiana Limestone shall be set in carefully prepared lime mortar tempered with stainless cement of an approved brand. The mixture to consist of one part dry Hydrated Lime or lump lime paste, to not over three parts sharp, **washed clean** sand, with the addition of stainless cement in an amount equal to 15 per cent by volume of the lime used.

Lump Lime Paste shall be made of best quality freshly burned lump lime slaked with cold water and screened through a three-sixteenths inch mesh screen into a settling box following the practice employed in preparing lime for plastering, the Lime Putty so prepared to stand in the settling box not less than one week and then be mixed with the sand and be properly stacked to age. In each case proper precautions shall be taken by covering or otherwise to absolutely prevent either the lime or mortar from drying out; the cement to be added and thoroughly worked into the mixture in small batches just prior to its use for the setting of the stone.

The sharp sand must be washed clean, entirely free from silt, vegetable matter, salts and all other injurious substances and must be screened if containing pebbles or very coarse grains that would interfere with the proper bedding and jointing of the work. The water must be clear and devoid of salts and all injurious chemical elements.

17. Scaffolding.

All scaffolding required for the proper execution of this work will be furnished and erected by the Masonry Contractor for the use of all mortar using trades.

18. Centering.

All wood centering required for the proper setting of Cut Stone work will be furnished and erected by the Carpentry Contractor.

19. Anchors & Dowels.

All anchors, dowels, clamps, Lewis anchors, etc., required by setting drawings or necessary for the proper erection of the work shall be of thoroughly galvanized iron. Anchors, etc., to be galvanized after they have been bent to shape.

20. Setting Cut Stone.

The Indiana Limestone shall be set in accordance with the requirements of the drawings. When ready for setting, all stone shall be washed on ALL sides and be scrubbed clean with soap and water applied with fibre brushes only and be thoroughly rinsed with clean water. Immediately prior to setting, all stone shall be sponged or drenched on all sides with clean water.

The stone shall be set accurately, true to line and level by competent stone setters, with full flushed joints. The face to be set on thoroughly soaked wooden wedges, which shall not be removed until the building is cleaned and pointed.

All beds and vertical joints shall be of a maximum width of ¼ inch except where otherwise indicated and mortar shall be raked out ¾ inch from the face of the stone to allow for pointing, and the stone be sponged off along all joints.

Splashing exposed faces of cut stone with mortar shall be avoided and any splashing shall be immediately removed with a sponge and clean water.

The entire backs of all stone, while wet, shall be plastered with not less than ½ inch coat of setting mortar before backing up same and where the stone occurs as a facing applied direct to previously erected structural members, both back of stone and face of structural work shall be plastered with setting mortar to insure a thoroughly filled back joint.

The ends only of all sills shall be set in a full bed of mortar, balance of sills to be left free until pointed.

Steps shall be set with a slight pitch to the front.

All cornices, copings and projecting belt courses and all stones forming gutters, etc., shall be set with the vertical joints dry. These joints shall be caulked on exposed surfaces with picked oakum and shall then be filled solid from above with a mortar grout. Grout shall be composed of one part non-staining cement and one part fine white sand, mixed in small quantities and of as thick consistency as can be poured into joints, and be stirred vigorously until used.

Where the Limestone extends down to the grade line of the building the first course above grade shall be placed on a layer of approved non-staining impervious material.

21. Backing Up Cut Stone.

The first course of brick next to stone facing, shall be laid in the same kind of mortar as used by Masons for setting of stone.

22. Protection of Finished Work.

The Contractor setting Cut Stone shall co-operate with the Carpentry Contractor who will furnish and erect the necessary protection for sills and projecting stone work.

23. Cleaning.

The face of all stone work under this contract shall be thoroughly cleaned upon completion, this cleaning to be done with soap or soap powder boiled in clean water and applied vigorously with stiff fibre brushes, if necessary, clean, sharp, fine, white sand to be added to the soap and water mixture.

Cut Stone Production Problems Skilfully Solved

Where Indiana Limestone is required, The Consolidated Stone Company can give exceptional service.

Its magnificent new mill at Bedford, Indiana, shows a careful study of the needs of the cut stone industry covering a period of fifty years. This mill, built entirely of Indiana Limestone, steel and glass, contains every machine known to the industry. It is the largest and most modern plant for the fabrication of cut stone in the world.

The highest efficiency in cut stone production is obtained in this mill, together with three additional plants and two quarries.

Architects, contractors and owners desirous of securing the service essential in large operations, are offered the advantages of this company's advanced methods.

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409 Reliance Bldg., Kansas City, Mo.
A. W. STEWARD, Builders' Exch., Toronto, Ont
E. E. DICKINSON Bedford, Ind

THE CONSOLIDATED STONE COMPANY

Box 300, Bedford, Indiana

After cleaning, the exposed surfaces are to be drenched with clear water.

The use of wire brushes or acids of any kind will not be permitted under any circumstances for cleaning the stone work.

24. Pointing.

All face joints shall be brushed out clean ¾ inch in depth, carefully removing all wedges so that pointing will be continuous and after a thorough wetting of the stone be pointed flush with mortar, consisting of one part stainless cement, two parts clean white sand and sufficient cold lime putty to make as stiff a mixture as can be worked.

Notes on the Design of Structural Steel for skeleton frame building that are to be faced with stone.

It is really very important that more careful consideration be given to the requirements of the facing material in the preliminary layout of structural steel work than is often the case.

The facing material along with the details of support for enclosure walls are very often studied only after the size and position of columns, girders and main beams, including even the spandrel members, have been fixed. This is not the best method of procedure, as a careful study of the Spandrel sections during the preliminary stages of design and layout of the structural frame will often result in considerable economy in the steel work.

Details for Spandrel sections should be carefully worked up in pencil during the early stages of preparing the small scale drawings, enabling them to be studied along with the Architectural features of the design and before the column centers and other lines have been definitely fixed; not afterward; as these are the first items of information needed by the Structural Engineer in the detailing of the steel. This is also the case when the frame is of reinforced concrete.

The Spandrel sections should be kept as simple as possible, using self-supporting stone lintels wherever practicable and all unnecessary steel be eliminated, when an Indiana Limestone facing is to be used; as a lot of small steel in the wall sections, angles, channels and loose lintel steel can frequently be omitted by a properly designed spandrel girder placed in the right position for the support of both facing and backing of enclosure walls.

It must also be remembered that masonry, particularly Stone work, is decidedly more rigid than steel and the steel work for the support of same should be designed with that in view. This may often mean that a single deep built-up plate and angle section is preferable to a plain rolled section or combination of shapes, for spandrel members.

This does not necessarily involve a greater weight of metal for spandrel girders or lintel members supporting masonry of walls but a different disposition of the material.

Any attempt to support the lintels or walls over wide openings with steel sections that will deflect appreciably under load, will usually occasion arch action in the masonry, preventing the steel from carrying the loads in the manner for which it was designed, which may cause excessive stresses in some portions of the masonry that may result in the crushing of mortar, opening of joints and sometimes even the spalling or chipping off of corners or cracking of the stone.

On the other hand to much steel in spandrel walls should be avoided; it is only necessary to have the supporting members stiff so that the steel frame will actually carry the load it is intended to carry without putting stress in the enclosure wall masonry. And another important point is to so detail the work that the Stone facing will not be pinched between supporting members of the structural frame, when slight movements due to temperature changes occur.

There is also a tendency to place wall Columns too close to the face of wall and it is usually advisable to fix the center line of these columns in a position that will permit the thickness of Stone Facing and one course of Brick work plus the proper allowance for joints between the outer face of steel and the normal face of wall in the shaft or main portion of building.

Placed in this position, the eccentric loading from walls can generally be balanced by the eccentric loading from floor girders and this will usually permit the flanges for the regular plate and angle columns to be turned out towards face of wall, where they best serve for resisting wind stresses and for wind bracing connections, permitting the floor girder connections to be placed on the opposite flange of these columns.

And it is very important in the erection to assure that the frame is carrying all of the enclosure wall load which it is intended to carry and that this load is not being supported largely by the Facing through the deflection and settling to bearing of the steel work in back of same. This may often mean in tall buildings that the erection of Stone Facing and Backing of enclosure walls should be started simultaneously at several different floor levels and the entire enclosure walls of the shaft and upper portions of the building be completed, before the Stone work of Base or lower stories is set.

It may not always be found practical to do this but the one point is to assure that frame is carrying the full load of upper walls, particularly when there is an Arcade of Colonnade treatment of Stone work forming the base portion of a tall building, as Stone work of this character in lower portion can usually be made self-supporting for several stories in height and for that reason steel should be kept out of it as far as practicable.

Stone Lintels should be made self-supporting whenever practicable. This is usually possible even in paired or grouped windows by the use of Stone Mullions which give a better appearance and greater structural stability to any Stone design. This often simplifies the Spandrel Sections, making it necessary to support only the Spandrel Panels and sills on the structural frame.

Where Shelf Angles for Lintels must be used, it is often better to use loose Lintels than to have them rigidly connected to the structural frame, and where such connections are considered advisable, it is generally best to bracket or hang them from the Spandrel Girder with a slotted bolt connection that will permit of some adjustment, which is nearly always necessary to bring Steel Members of this character into the exact position for the support of Stone.

This also applies to outlook angles which should never be rigidly connected but always fastened to the frame with a hooked or bolted connection over shim plates that will permit of adjustment into the exact position required for the support of projecting Stone work.

A little careful study given to details of this kind during the early stages of the Steel Design will usually result in the simplification of both the structural steel and the stone work and facilitate the erection of both.

SPECIFICATIONS RECOMMENDED FOR HOLLOW TILE FIREPROOFING

(1) In General:

The contractor for the fireproofing shall furnish all the Hollow Tile material required for the floor and roof construction, including the fireproofing of all structural steel work, beams, girders, lintels, columns, etc., excepting where steel is indicated as being encased in the wall or other masonry, or specifically referred to as being left exposed (such as roof trusses, elevator sheave beams, etc.), also the Hollow Tile for partitions, furring and such other work as indicated on the drawings.

This contractor shall furnish all labor, transportation, tools and equipment and all other materials required to erect the Hollow Tile fireproofing and other construction in accordance with the drawings and as hereinafter specified, all conforming to the best and latest practice and to the satisfaction of the architect; only skilled tile setters to be employed for the setting.

Contractors shall carefully examine the steel framing, drawings and structural details and provide for the complete and proper fireproofing of the structural frame.

(2) Material:

All Hollow Tile fireproofing shall be of hard burned (dense) or (semi-porous) ware that will develop a crushing strength of at least 1525 pounds per square inch of net sectional area of the tile when tested on end, and stamped with the Manufacturer's name or that of his association. No badly split, cracked, warped or underburnt tile shall be used.

Book tile roofing, solid beam and girder covering (nailing tile) and such other items as are specifially so noted shall be hard burned, full-porous ware.

All Hollow Tile fireproofing shall be capable of withstanding the tests prescribed by the "National Board of Fire Underwriters" standards for fire resistive floor, wall and partition construction.

(3) Size and Dimensions of Tile:

All Hollow Tile arching shall be of the shape required to carry and transmit the loads with an ample factor of safety.

Floor arch tile shall have the outside shells not less than ¾" in thickness and the webs not less than ⅝" in thickness, excepting that the shells and webs of keys and skewbacks, or other shapes that must resist both compression and shearing stress, shall be thicker when required. Skewbacks shall be designed to resist the combined shear and thrust from arch and be formed to fit and protect the various steel sections on which they are set.

Partition tile shall have shells not less than ⅝" and webs equal in thickness, number and arrangement to Hollow Building Tile Association Standard.

Cross webs in all arch and fireproofing shall be spaced not over 4" on centers and all blocks 8" or more in thickness shall have at least one mid-web.

The faces of all tile that are to receive plastering or mortar shall have the standard scoring. The thickness of the shells of side construction arches shall be made sufficient to resist the combined compression and shearing stresses, with ample fillets at all intersections of webs and shells.

Beam, girder and lintel fireproofing shapes when hollow shall have shells at least ⅝" in thickness, or if solid, be of porous or semi-porous ware and at least 1½" thick at extreme edge of metal.

(4) Fireproofing Steel:

The thickness of fireproofing around steel members shall in no case be less than the following (and thicker where necessary to conform to existing State or Municipal ordinances or by-laws):

Soffit coverings on lower flange of beams supporting flat arches shall be 1½" thick if of solid material and 2" thick if made hollow.

Covering on beams and girders extending below the soffit of arches: at least 2" thick for plain rolled sections, plate girders, trusses, etc. Web covering shall be built out solidly to the thickness required in all cases.

Solid Tile column fireproofing for round or other special columns shall be at least 2½" in thickness of porous or semi-porous ware.

(5) Detail Drawings:

This contractor shall submit to the architects for approval any required detail drawings, showing the form, section and method of applying the fireproofing to the steel work, etc., before starting the manufacture of material. Details to be full size where any special shapes are required.

Stock shapes may be used throughout for the fireproofing of beams and girders, columns, etc., where they conform to the requirements of this specification and fit the contour of the steel sections. Elsewhere the contracts shall furnish, without extra cost, all other shapes required to properly fit and encase the steel work.

(6) Scaffolding and Centers:

Contractor shall provide his own hoisting rig and all scaffolding, centers and forms required for the setting of his work. Scaffolding and centers to be provided in sufficient quantity to insure the rate of progress outlined in contract.

This contractor shall also furnish the proper protection for his men and for those working under him, as required by the City and State laws.

(7) Mortar and Laying:

All arches, fireproofing, partitions, furring, etc., shall be set in cement mortar composed by volumne of one part (approved brand) Portland cement to three parts clean sharp sand. Not over 15% of the cement by volume of hydrated lime may be added.

Cements, sand, etc., shall conform to the requirements elsewhere specified under the heading of "Masonry."

All steel work shall be coated with this mortar just ahead of the setting of fireproofing.

All tile shall be laid with full butted end and side joints and shall be shoved to a bearing on a full bed of mortar with as close a joint as possible, pointing up and filling all crevices with mortar.

In warm weather all tile shall be thoroughly wetted before setting. Frost shall be driven from the tile by heating when setting is carried on during cold weather and no fireproofing shall be set when the temperature is below 20 degrees Fahrenheit without the permission of the architect.

(8) Flat Arches:

All floors throughout (including the main roof and the roof in light court), except where otherwise noted, shall be constructed of . . ." deep end construction flat arches having (side construction) skewbacks and keys of the sizes required to fit the several spans without cutting.

Any additional keying or wedging required shall be done with tile slabs or slate.

Solid beam soffit tile shall be separate from the skewbacks and of the proper size, having bevelled sides so as to be securely keyed in place by the skewbacks.

Skewbacks shall be of the size required and be properly formed or coped to fit the various beam sections.

Whenever possible, any openings required in arches for pipes, etc., shall be formed or left at the time of setting so as to avoid later cutting.

(9) Segmental Arches:

All....................shall be 6" (or 8") deep, side construction segmental arches, set on skewbacks of the forms indicated on drawings, properly encasing the lower flange of beams, all segment lengtheners to be uniform size, except where smaller sizes are required for keying up, and shall be set with broken joints in each course, carefully fitting up to and between tie rods by using the required short lengths for starters and closures.

Solid beam soffit tile shall be separate from the skewback and of the proper size, having bevelled sides so as to be securely keyed in place by the skewbacks.

(10) Beam and Girder Covering:

All beams, girders, or other steel members, extending below the soffit of arches, shall be encased in Hollow Tile of the thickness specified, all to be properly fitted and set with well filled mortar joints encasing the entire length of beam and where necessary be securely strapped or clipped in place with 1" by No. 16 gauge band iron or No. 10 gauge galvanized iron wire. Where metal fastening is necessary, as in the case of wide soffits, the soffit tile shall be hollow and the metal clamp be arranged in the hollow space; these soffit tile to be also keyed into place by mortar joints. The fireproofing of main carrying beams and girders shall be independent of the floor arch construction and shall extend up to top flange so that openings for pipes, etc., that may be left or cut will not expose the webs or flanges of any members of the structural frame. All spandrel beams and girders and other lintel members shall be protected with the tile fireproofing where not indicated as being encased in the masonry of walls.

(11) Book Tile Roofing:

The roofs of penthouses and vent shafts, also the backs and ends of saw-tooth skylights and mansard roof and top of cornice and the pitched roofs of tower or dome, shall be constructed of 3" book tile, set on "T" irons which will be provided and erected by the steel contractor.

The floor of bulkheads in show windows shall also be constructed of book tile.

(12) Suspended Ceilings:

The ceiling under roof in (top) story and the ceiling of boiler room (also the soffits of stairs, where so indicated) shall be constructed of 3" book tile ceiling bolcks, set on "T" iron framing provided and erected by the steel contractor.

Book tile for ceilings shall be coped so as to give a level ceiling and before setting the lower flange of "T" irons shall be wrapped with a strip of galvanized light weight diamond mesh expanded metal, or galvanized woven wire mesh.

(13) Column Covering:

All interior columns (and such other columns that are so indicated on the drawings) shall be encased with Hollow Tile as indicated, set 1" free of the steel; all channel spaces in columns shall first be filled in solid with Hollow Tile or a fine stone or gravel concrete, or broken tile and cement mortar.

The steel column shall be plastered with a full ½" coat of Portland cement mortar just in advance of the setting of the tile covering.

Column covering shall in all cases start on the top of the fireproof floor construction and be carried up to the underside of fireproof ceiling above, each course of tile to be set breaking joint with the one below and be warped once in every course with 10-lb. galvanized iron wire, or be tied together with "U" shaped clips of band iron in each course.

Where so indicated, column covering shall have rounded corners.

No piping shall be enclosed in the column fireproofing, excepting electric conduits, not over ⅝" in size, built into the channel space before the column covering is set. These conduits shall be grouted in solid with at least 3" of solid material between conduit and the face of steel. All other piping at columns shall be separately inclosed in ducts as indicated and hereinafter specified.

(14) Wall Furring:

The furring of exterior walls (and the party walls where so shown, including the walls of basement), where free standing, shall be built of 3" (or 4") hollow partition tile, the same as partitions, elsewhere the furring of all exterior and party walls shall consist of 2" split furring tile built against and secured to the brick or other masonry with approved metal wall ties previously built into the masonry, or with galvanized heavy 4" wire nails driven into the joints of same every second course in height and not over 3' 0" apart.

Wall furring, where so indicated, shall be returned into jambs at windows (including the furring down at windows soffit).

(15) Special Furring, Pipe Enclosure, Etc.:

Where indicated on drawings, the walls, columns, piers, etc., shall be furred out to the lines required by the architectural details for the special form and finish of the room, corridors, etc., as indicated, forming all offsets, reveals pilasters, etc., using partition tile of the required size. In general this work shall be done with 3" partition tile with brace or cross walls of same size blocks wherever required. Cross walls shall

be anchored or tied into both furring and masonry.

All piping, conduits, etc., where so indicated shall be inclosed with 2" or 3" partition tile; chases in walls to be similarly covered. This work shall be independent of the column fireproofing and be arranged so that the piping is left accessible until after it has been tested.

(16) Partitions:

All partitions and interior division walls shall be built of light weight Hollow Partition Tile of the several thicknesses indicated on drawings. Sizes not marked on plans shall be as follows:

Partitions enclosing elevator and stair walls, pipe shaft, etc., and all partitions over 18' 0" in height to be 6" thick.

Division walls in stores on ground story to be 8".

All main and corridor partitions and all partitions around toilet rooms, etc., also all sub-dividing partitions over 14' 0" in height to be 4" thick.

All other partitions to be 3" thick.

All division walls, main and corridor partitions shall start directly on the arches; but sub-dividing partitions may be built on the floor filling and where so indicated shall be built on the top of finished floor to provide for tenent changes.

All partitions to be carried up to and be wedged tightly against the underside of fireproof ceiling or beams above.

Where there are more than two courses of partition tile the heads of doors or other openings in sub-dividing partitions and over all openings wider than 3' 6" jack arches, light steel lintels or suitable reinforcement of band iron shall be provided and similar lintels shall be provided over all openings in main partition wall furring, etc.

All partitions shall be built true to a line and plumb and at all intersections shall be bonded together or be tied with approved metal ties or with band iron. Provision shall be made for securely anchoring all heavy frames which are not fastened to the steel framing.

All partitions, furring, column casing or other items built with partition or furring tile shall be well bonded by breaking joints at least 3" in each course, all joints to be thoroughly bedded and flushed and pointed up with mortar.

Double partitions shall be bonded together and stiffened with cross walls of the same material, as shown on drawings. All anchors, ties, etc., required for this work to be furnished by this contractor.

(17) Vaults:

The lining of fireproof vaults shall consist of a 4" Hollow Partition Tile built 2" free of and anchored to the vault wall masonry by hollow header brick. The wall of storage vaults on .. stories shall consist of a double 4" partition tile (or a double 4" and 6" partition) breaking joints in each course. Vault doors to be securely anchored at least two courses deep in every second course.

(18) Pent Houses and Other Walls:

The walls of pent houses and vent shafts on roof (also the wall of pipe tunnel back of cornice) shall be built of 8" exterior wall tile having a deep scoring to receive the cement stucco. All openings in tile at the top of these walls shall be capped with a tile (slab) before the cresting or coping is set.

(19) Bulkheads and Skylight Curbs:

The bulkheads and skylight curbs where indicated as covered with sheet metal shall be built of 3" (or 4") thick Hollow Partition Tile. Elsewhere they shall be built of 6" (or 8") exterior wall tile same as pent houses. The roof of bulkheads (unless otherwise shown) shall be constructed of 3" book tile, set on loose "T" iron which will be furnished by another contractor but be set by this contractor.

(20) Miscellaneous Iron:

All loose light steel sections and miscellaneous ironwork occurring in connection with the Hollow Tile fireproofing work, excepting anchors, ties (reinforcement), band iron, etc., will be furnished by other contractors, but shall be set by this contractor without extra charge.

(21) Raised Floor:

The raised floors in toilet room where indicated shall be constructed of 3x12x18 book tile or heavy section partition tile set on dwarf walls of partition tile and brick. This work shall be so arranged as not to interfere with the installation of the plumbing work. These floors to be closed up only after the pipes have been tested and approved.

(22) Roof Fill and Finish:

Here specify cinder-fill and cinder, slag or sawdust concrete being careful to require protection against corrosion around pipes.

(23) Load Tests:

All Hollow Tile arches shall be capable of sustaining a load of three times the required live load, per square foot, and they shall be tested by the contractor where so directed by the architects.

(24) Cutting and Patching:

This contractor alone shall do all cutting and patching of the arching, beam, girder and column fireproofing that may be required for the roughing in of piping, etc., or the installation of other work, the cost of which (actual labor cost plus 10%) shall be reported to the general contractor (or architect), who will adjust same with the contractors for whom this work is done.

The cutting and patching of partitions and furring, etc., will be paid for by the contractors whose work occasions same.

All other cutting and patching and the repairing of all Hollow Tile work so as to leave the whole work perfect and complete shall be done by this contractor at his own expense.

(25) Removal of Rubbish:

Upon completion of the Hollow Tile fireproofing and whatever else required by the architect's superintendent, this contractor shall clean up and remove from the premises any refuse and surplus material resulting from this work, leaving the premises clear of such rubbish. This contractor, however, may use the broken tile in the floor filling, provided same is broken into **small pieces and kept free from plaster, wood chips and other rubbish.**

STANDARD SPECIFICATIONS FOR CONCRETE FLOORS

That preference for concrete as a building material is on the increase is evident even to the casual observer as well as to the architects and engineers. Millions of square feet of concrete floors are in use and such floors will be found in all types of buildings. The importance, therefore, of using the latest and best methods in constructing concrete floors is obvious.

Best practice in the use of any material in construction for which it is adapted is necessary for best results. Concrete floors are no exception to this rule and the reason why some floors are hard, firm and resistant to abrasion while others constructed of suitable materials by contractors of intelligence and integrity are not satisfactory, is found in the methods and practices of manipulating the materials and curing the finished floor.

Concrete is essentially a modern construction material and it is only natural and inevitable that earlier methods would be susceptible to improvement. Large areas of concrete floors have been laid with only the observation and experience of engineers as a guide as to how to obtain the greatest strength and most desired qualities in the finished product. It is noteworthy that in many instances, in spite of lack of the guidance of laboratory investigations, individuals did learn by experience how to make concrete of very excellent quality. But searching scientific investigation for the purpose of revealing the fundamental principles of manipulating concrete materials to produce best results was doubtless delayed by the degree of excellency obtained in many of the floors constructed with only experience and observation as a guide.

The Structural Materials Research Laboratory at Lewis Institute has devoted much time to wear tests of concrete and through the results of thousands of tests has arrived at definite conclusions about how to proceed to produce concrete to resist wear.

In addition to these extensive laboratory investigations committees of engineering societies and organizations have been at work formulating specifications to serve as a guide to field practice. The American Concrete Institute has had for years a committee on concrete floor which has from year to year submitted suggested specifications for concrete floors. These suggested specifications have finally been adopted as a standard and are given below.

Special emphasis should be given in applying the specifications regarding the amount of water to be used in mixing concrete, to the methods of finishing—that is, troweling—and to curing the finished floor. Neglect of these factors or ignorance of their importance is responsible for a vast majority of such floors as have not proven satisfactory. Dusting may result from too fine, dirty or otherwise unsuitable sand, too little cement in the mixture, too much troweling, the use of driers and finally permitting the concrete to dry out too rapidly after placing.

GENERAL REQUIREMENTS
MATERIALS

1. Cement: The cement shall meet the requirement of the current Standard Specifications for Portland Cement adopted by the American Society for Testing Materials.

2. Aggregates: Before delivery on the job, the contractor shall submit to the architect or engineer a fifty (50) pound sample of each of the aggregates proposed for use. These samples shall be tested, and if found to pass the requirements of the specifications, similar material shall be considered as acceptable for the work. In no case shall aggregates containing frost or lumps of frozen material be used.

(a) **Fine Aggregate:** Fine aggregate shall consist of natural sand or screenings from hard, tough, crushed rock or gravel, consisting of quartz grains or other equally hard material, clean and free from any surface film or coating and graded from fine to coarse, with the coarse particles predominating. Fine aggregate, when dry, shall pass a screen having four (4) meshes to the linear inch; not more than twenty-five (25) per cent shall pass a sieve having (50) meshes per linear inch and not more than five (5) per cent shall pass a sieve having one hundred (100) meshes per linear inch. Fine aggregate shall not contain injurious vegetable or other organic matter as determined by the colorimetric test nor more than five (5) per cent by volume of clay or loam. Field tests may be made by the architect or engineer on fine aggregate as delivered at any time during progress of the work. If there is more than seven (7) per cent of clay or loam by volume in one (1) hour's settlement after shaking in one hundred (100) per cent excess of water, the material represented by the sample shall be rejected.

Briefly the colorimetric test may be applied in the field as follows: Fill a twelve (12) ounce graduated prescription bottle to the four and one-half (4½) ounce mark with the sand to be tested. Add a three (3) per cent solution of sodium hydroxide until the volume of sand and solution, after shaking amounts to seven (7) ounces. Shake thoroughly and let stand for twenty-four (24) hours. The sample shall then show a practically colorless solution or at most a solution not darker than straw color.

Fine aggregate shall be of such quality that mortar composed of one (1) part Portland Cement and three (3) parts fine aggregate, by weight, when made into briquets, shall show a tensile strength at seven (7) and twenty-eight (28) days at least equal to the strength of briquets composed of one (1) part of the same cement and three (3) parts standard Ottawa sand, by weight. The percentage of water used in making the briquets of cement and fine aggregate shall be such as to produce a mortar of the same consistency as that of the Ottawa sand briquets of standard consistency. In other respects all briquets shall be made in accordance with the methods of testing cement recommended by the American Society for Testing Materials. (See Cement Specifications, A. S. T. M.)

(b) **Coarse Aggregate:** Coarse aggregate shall consist of clean, hard, tough, crushed rock or pebbles graded in size, free from vegetable or other organic matter, and shall contain no soft, flat or elongated particles. The size of the coarse aggregate shall range from one and one-half (1½) inches down, not more than five (5) per cent passing a screen having four (4) meshes per linear inch, and no intermediate sizes shall be removed.

(c) **No. 1 Aggregate for Wearing Course:** No. 1 Aggregate for the wearing course shall consist of clean, hard, tough, crushed rock or pebbles, free from vegetable or other organic matter, and shall contain no soft, flat or elongated particles. It shall pass when dry a screen having three-eighths (⅜) inch openings and not more than ten (10) per cent shall pass a screen having four (4) meshes per linear inch.

3. Mixed Aggregate: Crushed run stone, bank-run gravel or mixture of fine and coarse aggregate prepared before delivery on the work shall not be used.

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Konax, when mixed with concrete as directed, provides four very desirable conditions:

(1) Accelerates the initial and final set and increases the early tensile strength; (2) gives greater plasticity and workability; (3) increases density, and (4) increases freezing resistance.

When Konax is used, finishing is possible within a very short time after the placing of the concrete. Concrete, with Konax, can be placed at 8 o'clock and at 11 o'clock be floated and troweled two times to a hard finish without bringing to the surface cement and fine sand to cause dusting.

Furthermore, as Konax sets the bottom of the concrete as fast as the top, it gives a better wearing surface.

The efficiency of Konax is not impaired by the weather. The action of Konax enables brickwork and concreting to proceed at exceptionally low temperatures. Konax lowers the freezing point of the water, at the same time hastening the setting.

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4. Subbase: Only clean, hard material, such as coarse gravel or steam-boiler cinders, free from ash or particles of unburned coal, shall be used in the subbase. (Note: Eliminote this clause when subbase is not required.)

5. Water: Water shall be clean, free from oil, acid alkali or vegetable matter.

6. Color: If artificial coloring matter is required, only those mineral colors shall be used which, in the amount hereinafter specified, will not appreciably impair the strength of the cement.

7. Reinforcement: The reinforcing metal shall meet the requirements of the current Standard Specifications for Steel Reinforcement of the American Society for Testing Materials. It shall be free from excessive rust, scale, paint or coatings of any character which will tend to reduce or destroy the bond.

8. Joint Filler: The joint filler shall be a suitable compound that will not become soft and run out in hot weather, nor hard and brittle and chip out in cold weather; or, prepared strips of fibre matrix and bitumen as approved by the architect or engineer. The strips shall be one-half (½) inch in thickness and their width shall at least equal the full thickness of the slab.

MEASURING AND MIXING

9. Measuring: The method of measuring the materials for the concrete or mortar, including water, shall be one which will insure separate and uniform proportions of each of the materials at all times. A sack of Portland Cement (94 pounds net) shall be considered as one (1) cubic foot.

10. Machine Mixing: All concrete shall be mixed by machine except when the architect or engineer shall otherwise permit under special conditions. A batch mixer of an approved type shall be used. The ingredients of the concrete or mortar shall be mixed to the specified consistency, and the mixing shall continue for at least one (1) minute after all the materials are in the drum. Raw materials shall not be permitted to enter the drum until all the material of the preceding batch has been discharged.

11. Hand Mixing: When it is necessary to mix by hand, the materials shall be mixed dry on a watertight platform until the mixture is of uniform color, the required amount of water added, and the mixing continued until the mass is of uniform consistency and homogeneous.

12. Retempering: Retempering of mortar or concrete which has partially hardened, that is, mixing with or without additional materials or water, shall not be permitted.

PROTECTION

13. Treatment: As soon as the finished floor has hardened sufficiently to prevent damage thereby, the floor shall be covered with at least one (1) inch of wet sand or two (2) inches of sawdust which shall be kept wet by sprinkling with water for at least ten (10) days.

14. Protection: The freshly-finished floor shall be protected from hot sun and drying winds until it can be sprinkled and covered as above specified. The concrete surface must not be damaged or pitted by raindrops, and the contractor shall provide and use when necessary sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours.

15. Temperature Below 35 Degrees Fahrenheit: If at any time during the progress of the work the temperature is, or in the opinion of the architect or engineer will within twenty-four (24) hours drop to, 35 degrees Fahrenheit, the water and aggregates shall be heated and precautions taken to protect the work from freezing for at least five (5) days.

REINFORCED CONCRETE FLOORS

For reinforced concrete floors the following will apply in addition to the general requirements.

16. Forms: The forms shall be substantial, unyielding and so constructed that the concrete will conform to the designed dimensions and contours, and shall also be tight to prevent the leakage of motar. The supports for floors shall not be removed in less than ten (10) days after the concrete is placed, and then only with the consent of the architect or engineer in charge. When freezing weather occurs, the supports shall remain in place an additional time, equal to the time the floor has been exposed to freezing.

17. Reinforcement: Reinforcing metal shall be provided as called for on the plans. It shall be placed as indicated and mechanically held in position so that it will not become disarranged during the depositing of the concrete. Whenever it is necessary to splice tension reinforcement, the character of the splice shall be such as will develop its full strength. Splices at points of maximum stress shall be avoided. Splicing by lapping bars without contact and with space between bars along the over-lap equal to twice the thickness of the bars is preferable to mechanical splices or clamps.

CONCRETE SLAB

18. Proportions: The concrete shall be mixed in the proportions by volume of one (1) sack of Portland Cement, two (2) cubic feet of fine aggregate and four (4) cubic feet of coarse aggregate.

19. Consistency: The materials shall be mixed wet enough to produce a concrete of a consistency that may be readily caused to flow into the forms and about the reinforcement, but which can be conveyed from the mixer to the forms without the separation of the coarse aggregate from the mortar.

20. Placing: The concrete shall be placed in a manner to insure a smooth ceiling, and thoroughly worked around the reinforcement and into the recesses of the forms. Concrete shall be deposited in its full position as soon as possible after mixing and within (30) minutes after the water has been added to the dry materials. It shall be struck off to a surface at least one (1) inch below the established grade of the finished surface of the floor. Workmen shall not be permitted to walk in freshly laid concrete, and if sand or dust collects on the base, it shall be carefully removed before the wearing course is applied.

21. Joints: When it is necessary to make a joint in a floor slab, its location shall be designated by the architect or engineer; joints to be vertical.

WEARING COURSE

22. Proportions and Thickness (Mixture No. 1): The mortar shall be mixed in the proportions of one (1) sack of Portland Cement and two (2) cubic feet of fine aggregate. The minimum thickness shall be three-quarters (¾) inch.

23. Proportions and Thickness (Mixture No. 2): The mortar shall be mixed in the proportions of one (1) sack of Portland Cement, one (1) cubic foot of fine aggregate and one (1) cubic foot of No. 1 aggregate for wearing course. The minimum thickness shall be one (1) inch.

24. Consistency: The mortar shall be of the dryest consistency possible to work with a sawing motion of the strikeboard.

25. Placing: The wearing course shall be placed immediately after mixing. It shall be deposited on the fresh concrete of the base before the latter has appreciably hardened, and brought to the established grade with a strikeboard.

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NOTE: When placing the wearing course after the concrete slab has hardened, eliminate paragraph 25 and substitute the following:

26. Preparation of Slab: The surface of the slab shall be thoroughly roughened by picking, and swept clean of all dirt and debris.

27. Placing: The slab shall be thoroughly moist but free from pools of water when the grout and mortar for wearing course is placed. A neat cement grout shall be brushed on the surface of the slab, the wearing course immediately applied and brought to the established grade with a strikeboard. Grout and mortar shall be used within forty-five (45) minutes after mixing with water.

28. Finishing: After the wearing course has been brought to the established grade by means of a strikeboard, it shall be worked with a wood float in a manner which will thoroughly compact it and provide a surface free from depressions or irregularities of any kind. When required, the surface shall be steel-troweled, but excessive working shall be avoided. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or to hasten the hardening, but the Bruner method may be used if desired.

29. Coloring: If artificial coloring is used, it must be incorporated with the entire wearing course and shall be mixed dry with the cement and aggregate until the mixture is of uniform color. In no case shall the amount of coloring exceed five (5) per cent of the weight of the cement.

PLAIN CONCRETE FLOORS

For plain concrete floors the following will apply in addition to the general requirements:

SUBGRADE

30. Preparation: All soft and spongy places shall be removed and all depressions filled with suitable material which shall be thoroughly compacted in layers not exceeding six (6) inches in thickness. The subgrade shall be thoroughly tamped until it is brought to a firm, unyielding surface.

31. Deep Fills: All fills shall be made in a manner satisfactory to the architect or engineer. The use of muck, quicksand, soft clay, spongy or perishable material is prohibited.

32. Drainage: When required, a suitable drainage system shall be installed and connected with sewers or other drains indicated by the engineer.

33. Depth: The subgrade shall be not less than......(00) inches below the finished surface of the floor.

NOTE:. Subgrade is to be five (5) inches below the finished surface of the floor when subbase is not required, and at least eleven (11) inches below when subbase is required.

SUBBASE

(Omit these sections when subbase is not required.)

34. Thickness: On the subgrade shall be spread a material as hereinbefore specified, which shall be thoroughly rolled or tamped to a surface at least......(00) inches below the finished grade of the floor. On fills, the subbase shall extend the full width of the fill.

35. Wetting: While compacting the subbase, the material shall be kept thoroughly wet, and shall be in that condition when the concrete is deposited.

FORMS

36. Materials: Forms shall be free from warp and of sufficient strength to resist springing out of shape.

37. Setting: The forms shall be well staked or otherwise held to the established lines and grades and their upper edges shall conform to the established grade of the floor.

38. Treatment: All wood forms shall be thoroughly wetted and metal forms oiled or coated with soft soap or whitewash before depositing any material against them. All mortar and dirt shall be removed from forms that have been previously used.

CONSTRUCTION

39. Size of Slabs: The slabs or independently-divided blocks when not reinforced shall have an area of not more than one hundred (100) square feet, and shall not have dimensions greater than ten (10) feet. Larger slabs shall be reinforced as hereinafter specified.

40. Thickness of Floor: The thickness of the floor shall be not less than five (5) inches.

41. Width and Location of Joints. When required by the architect or engineer in charge, a one-half (½) inch space or joint shall be left between the floor and the walls and columns of the building, to be filled with the material before specified under "Joint Filler."

42. Protection of Edges: Where required by the architect or engineer in charge, the edges of the slabs at the joints shall be protected by metal. Unless protected by metal, the upper edges of the slabs shall be rounded to a radius of one-half (½) inch.

TWO-COURSE FLOOR

Concrete Base.

43. Proportions: The concrete shall be mixed in the proportions by volume of one (1) sack of Portland Cement, two and one-half (2½) cubic feet of fine aggregate and five (5) cubic feet of coarse aggregate.

44. Consistency: The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under slight tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

45. Placing: After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections to the required depth and width. Under no circumstances shall concrete that has partly hardened be used. The forms shall be filled and the concrete struck off and tamped to a surface the thickness of the wearing course below the established elevation of the floor. The method of placing the various sections shall be such as to produce a straight, clean-cut joint between them so as to make each section an independent unit. If dirt, sand or dust collects on the base it shall be removed before the wearing course is applied. Workmen shall not be permitted to walk on the freshly laid concrete. Any concrete in excess of that needed to complete a section at the stopping of work shall not be used. In no case shall concrete be deposited upon a frozen subgrade or subbase.

46. Reinforcing: Slabs having an area of more than one hundred (100) square feet, or having dimensions greater than ten (10) feet, shall be reinforced with wire fabric, or with plain or deformed bars. The reinforcement shall have a weight of not less than twenty-eight (28) pounds per one hundred (100) square feet. The reinforcement shall be placed upon and slightly pressed into the concrete base immediately after the base is placed. It shall not cross joints and shall be lapped sufficiently to develop the full strength of the metal.

WEARING COURSE

47. Proportions for Mixture No. 1: The wearing course shall be mixed in the proportions of one (1) sack of Portland Cement, two (2) cubic feet of fine aggregate. The minimum thickness shall be three-quarters (¾) inch.

48. Proportions for Mixture No. 2: The wearing course shall be mixed in the proportions of one (1) sack of Portland Cement and one (1) cubic foot of fine aggregate, and one (1) cubic foot of No. 1 aggregate for wearing course. The minimum thickness shall be one (1) inch.

49. Consistency: The mortar shall be of the dryest consistency possible to work with a sawing motion of the strikeboard.

50. Placing: The wearing course shall be placed immediately after mixing. It shall be deposited on the fresh concrete of the base before the latter has appreciably hardened, and brought to the established grade with a strike-board. In no case shall more than forty-five (45) minutes elapse between the time the concrete for the base is mixed and the wearing course is placed.

51. Finishing: After the wearing course has been brought to the established grade by means of a strikeboard, it shall be worked with a wood float in a manner which will thoroughly compact it and provide a surface free from depressions or irregularities of any kind. When required, the surface shall be steel-troweled, but excessive working shall be avoided. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or to hasten the hardening, but the Bruner method may be used if desired. Unless protected by metal the surface edges of all slabs shall be rounded to a radius of one-half (½) inch.

52. Coloring: If artificial coloring is used, it must be incorporated with the entire wearing course, and shall be mixed dry with the cement and aggregate until the mixture is of a uniform color. In no case shall the amount of coloring exceed five (5) per cent of the weight of the cement.

ONE-COURSE FLOOR

53. Proportions: The concrete shall be mixed in the proportions of one (1) sack of Portland Cement to not more than two (2) cubic feet of fine aggregate and not more than three (3) cubic feet of coarse aggregate, and in no case shall the volume of the fine aggregate be less than one-half (½) the volume of the coarse aggregate.

A cubic yard of concrete in place shall contain not less than six and eight-tenths (6.8) cubic feet of cement.

54. Consistency: The materials shall be mixed with sufficient water to produce a concrete which will hold its shape when struck off with a strikeboard. The consistency shall not be such as to cause a separation of the mortar from the coarse aggregate in handling.

55. Placing: After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections to the required depth and width. Under no circumstances shall concrete that has partly hardened be used. The forms shall be filled and the concrete brought to the established grade with a strike-board. The method of placing the various sections shall be such as to produce a straight, clean-cut joint between them so as to make each section an independent unit. Any concrete in excess of that needed to complete a section at the stopping of work shall not be used. Workmen shall not be permitted to walk on the freshly-laid concrete. In no case shall concrete be deposited upon a frozen subgrade or subbase.

56. Reinforcing: Slabs having an area of more than one hundred (100) square feet, or having any dimensions greater than ten (10) feet, shall be reinforced with wire fabric or with plain or deformed bars. The reinforcement shall have a weight of not less than twenty-eight (28) pounds per one hundred (100) square feet. The reinforcement shall be placed upon and slightly pressed into the concrete base immediately after the base is placed. It shall not cross joints and shall be lapped sufficiently to develop the full strength of the metal.

57. Finishing: After the concrete has been brought to the established grade by means of a strikeboard, and has hardened somewhat, but is still workable, it shall be floated with a wood float in a manner which will thoroughly compact it and provide an even surface. When required, the surface shall be steel-troweled, but excessive working shall be avoided. Unless protected by metal the surface edges of all slabs shall be rounded one-half (½) inch.

BUILDING CODE REQUIREMENTS FOR LIVE LOAD IN VARIOUS CITIES

In Pounds Per Square Foot

STRUCTURE	Baltimore	Boston	Buffalo	Chicago	Cincinnati	Indianapolis	Milwaukee	Minneapolis	New Orleans	New York	Philadelphia	Pittsburgh	St. Louis	San Francisco	Seattle	Washington
Apartments	60	50	70	40	40	50	30	50	40	.	70	...	50	60	40	50
Assembly Halls	...	...	100	100	100	125	...	125	..	100	120	150	100			
Dwellings	60	50	40	40	40	50	30	50	40	40	70	70	50	60	40	50
Hospitals	...	...	70	50	...	50	30	50	..	..	70	...	50	60	50	
Hotels	60	...	70	50	40	75	30	50	40	..	70	...	50	60	40	50
Manufacturing	175	...	...	...	150	200	...	...	...	...	150	200	150	250		
Light Manufacturing	125	125	120	100	100	100	100	100	125	..	120	...	100	125	125	
Heavy Storehouses	250	250	...	...	150	200	...	...	...	...	150	...	.	250		150
Warehouses	...	250	150	..	150	200	...	...	200	...	150	200	150	250		150
Offices	75	100	70	50	50	75	40	75	70	60	100	...	60	60	50	75
Schools—Class Rooms	75	60	...	...	60	100	40	100	60	75	..		75	75	50	75
Stairways, General	...	70	...	100	80	...	60	...	70	...					100	..
Roofs—Slope Under 20°	...	40	40	25	25	30	30	50	30	40	30	50	30	30	40	25
Wind Pressure	30	...	30	20	20	..	30	30	...	30	30	...	30	20		30

STANDARD SPECIFICATIONS FOR SOUTHERN YELLOW PINE TIMBERS

As Recommended by The Illinois Society of Architects

DEFINITION FOR SOUTHERN YELLOW PINE.

(Authorized reprint from the copyrighted Standards of The American Society for Testing Materials, Philadelphia, Pa.)

Southern Yellow Pine.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as long leaf pine (Pinus palustris), short leaf pine (Pinus echinata), loblolly pine (Pinus taeda), Cuban pine (Pinus heterophylla) and pond pine (Pinus serotina).

Under this heading two classes of timber are designated: (A) dense Southern yellow pine and (B) sound Southern yellow pine. It is understood that these two terms are descriptive of quality rather than of botanical species.

(a) **Dense Southern Yellow Pine** shall show on either end an average of at least six annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth, and fifth inches of a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3″ on an approximate radial line beginning at the edge nearest the pith in timbers over 3″ in thickness and on the second inch (on the piece) nearest to the pith in timbers 3″ or less in thickness.

In dimension material containing the pith but not a 5″ radial line, which is less than 2x8″ in section or less than 8″ in width, that does not show over 16 sq. in. on the cross-section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5″ radial line the inspection shall apply to the three inches farthest from the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller the average summer wood and number of rings shall be the average of the two radial lines chosen.

(b) **Sound Southern Yellow Pine** shall include pieces of Southern pine without any ring or summer wood requirement.

GENERAL TIMBER SPECIFICATIONS.

All timber except No. 1 Common must be free from defects such as injurious ring or round shakes, and through shakes that extend to the surface; unsound and loose knots, and knots in groups that will materially impair the strength. Seasoning checks and discolored sap shall not be considered defects in any grade.

KNOTS.

(Adopted by the American Society for Testing Materials, Augus 21 1915.)

Knots shall be classified as round and spike in form and for quality as sound, encased, loose and unsound.

A **round knot** is one which is oval or circular in form.

A **spike knot** is one sawn in a lengthwise direction; the mean or average width shall be considered in measuring these knots.

A **sound knot** is one which is solid across its face and which is as hard as the wood surrounding it; it may be either red or black, and is so fixed by growth or position that it will retain its place in the piece.

An **encased knot** is one whose growth rings are not intergrown and homogeneous with the growth rings of the piece it is in. The encasement may be partial or complete; if intergrown partially or so fixed by growth or position that it will retain its place in the piece, it shall be considered a sound knot; if completely intergrown on one face, it is a watertight knot.

A **loose knot** is one not firmly held in place by growth or position.

A **rotten knot** is one not as hard as the wood it is in.

WANE.

Wane is bark, or the lack of wood from any cause, on edges of timbers.

SHAKES.

Shakes are splits or checks in timbers which usually cause a separation of the wood between annual rings.

Ring shake: An opening between the annual rings.

Through shake: A shake which extends between two faces of a timber.

Shakes not hereinbefore described unless known to have extensive penetration shall not be considered a defect under this classification.

SIZES.

All rough timber, except No. 1 Common must be full size when green. One-quarter inch shall be allowed for each side surfaced.

LENGTHS.

Standard lengths are multiples of two feet, eight to twenty feet, inclusive, extra lengths are multiples of two feet, twenty-two feet and longer. When lineal average is specified, standard of lengths shall be multiples of one foot.

GRADES OF TIMBERS.

HEART TIMBERS.

All timber specifications, except "Merchantable" specifying heart requirements, shall be considered as a special contract, and shall specify whether the heart requirements refer to cubical contents or surface measurements in each piece.

NO. 1 COMMON TIMBERS.

May be either Dense or Sound Pine.

Common timbers rough 4x4 and larger shall be not more than ¼″ scant at any point when green, and be well manufactured and may have 1½″ wane on one corner one-third the length of the piece, or its equivalent on two or more corners; the wane measured on its face.

Timbers 10x10 in size may have 2″ wane as above; the larger sizes may have wane as above in proportion to sizes.

The diameter of any one knot shall not exceed 2″ in 4x4 to 6x6; 2½″ in 6x8 to 8x10; 3″ in 10x10 to 10x12; 3½″ in 12x12 to 12x14; 4″ in 14x14 to 14x16; 4½″ in 16x16 to 16x18. In sizes not mentioned the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on same basis as above specified.

In determining the size of knots, mean or average diameter shall be taken, or the equivalent of the above in grouped knots at any one point. Shakes one-sixth the length of the piece, small unsound knots and a limited number of pin worm holes, well scattered, are inadmissible.

SQUARE EDGE AND SOUND TIMBERS.

May be either Dense or Sound Pine.

Square edge and sound timbers shall be well manufactured and conform to the General Timber Specifications, admitting sound knots, and shall be free from wane.

MERCHANTABLE TIMBERS.

May be either Dense or Sound Pine

All merchantable timbers shall be well manufactured and conform to the General Timber Specifications.

Sizes under 9″ on the largest dimension, shall show two-thirds or more heart surface on one of the wide faces; sizes 9″ and over on the largest dimension shall show two-thirds or more heart on both of the wide faces. When sticks are square the face showing the most heart shall govern the inspection on sizes under 9″, and the two faces showing the most heart shall govern the inspection when 9″ and over. Heart showing the full length, even if not two-thirds of the area as above, shall meet the requirements of this quality.

Wane not exceeding one-eighth of the dimension of the face and one-quarter of the length of the piece on one corner, or the equivalent on two or more corners on not to exceed ten per cent of the pieces, shall be admitted.

SELECT STRUCTURAL MATERIAL.

(A rule incorporating suggestions by the United States Forest Service.)

REQUIREMENTS FOR DENSITY AND RATE OF GROWTH.

1. Shall contain only sound wood and be well manufactured.

2. Shall conform to the definition of Dense Southern Pine as adopted by the American Society for Testing Materials, August 21st, 1915, shown on page 6.

For the purpose of determining whether any given piece meets the requirements for density and rate of growth, the following rule, suggested by the United States Forest Service, shall be applied. It will be sufficient if either end passes the inspection.

(1) Pith Present or Accurately Located.

(A) Radial line of 5″ present.
  (a) Apply inspection over third, fourth and fifth inches.
(B) Radial line of 5″ not present.
  (a) Apply inspection to the second inch on 2x3, 2x4, 2x6, 3x3, 3x4, 4x4, or any other dimension material that has less than 16 square inches on the cross section.
  (b) In the larger material apply inspection to the 3 inches farthest from the pith.

(2) Pith Not Present or Cannot be Accurately Located.

(A) Material over 3″ thick apply inspection to three inches nearest the pith.
(B) Dimension material 3″ or less in thickness apply inspection to second inch of the piece nearest the pith.

(3) The Radial Line Chosen Shall Show a Representative Number of Annual Rings of Growth and Per Cent of Summer Wood.

Restrictions on Knots in Beams.

3. Shall not have in Volume 1 sound knots greater in diameter than one-fourth the width of the face on which they appear—maximum knot 1½″. Shall not have in Volume 2 sound knots greater in diameter than one-half the width of the face on which they appear—maximum knot 3 inches.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

The diameter of a knot on the narrow or horizontal face of a beam is to be taken as its projection on a line perpendicular to the edge of the timber. On the width or vertical face, the smallest dimension of a knot is to be taken as its diameter.

Restrictions on Knots in Columns.

4. Shall not have sound knots greater in diameter than one-third the least width of the column—maximum knots 4 inches.

Restrictions on Shakes and Checks in Beams.

5. Round or ring shakes shall not occupy, at either end of a timber, more than one-fourth the width of green material, nor more than one-third the width of seasoned material.

Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable round-shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber.

Restrictions on Cross Grain in Beams.

6. Shall not have diagonal grain with slope greater than one in twenty in Volume 1.

ABBREVIATIONS OF TIMBER GRADES.

For the purpose of branding timbers with the names of the grades it is recommended that the following abbreviations be used:

SQ EDG-SD —Square Edge and Sound
NO 1 COM —No. 1 Common
MERCH Merchantable.
SEL STRUC—Select Structural.

ARCHITECTS SPECIFICATIONS FOR SOUTHERN YELLOW PINE STRUCTURAL TIMBERS.

(1) When Both Maximum Durability and Strength Are Required.

Longleaf southern yellow pine of "select structural material grade" in accordance with the definition of "Dense Southern Yellow Pine" as adopted by the American Society for Testing Materials (August, 1915), and the Southern Pine Association ("Density Rule" book, March 15, 1916). To be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(2) When Strength Is Required Without Special Reference to Durability.

Southern yellow pine of "select structural material grade" as defined in Section (1) above. To be dressed to standard sizes conforming to the rules of the Southern Pine Association and branded in accordance with the official requirements of that Association.

(3) When Used Without Reference to Durability or Maximum Strength.

No. 1 Common southern yellow pine timbers of "dense" grade as defined in the "Timber Rule" book of the Southern Pine Association (March 15, 1916). To be dressed to standard sizes conforming to the rules of the Southern Pine Association.

(4) When Used for Joists, Studs, etc., in Ordinary or Minor Structures Without Reference to Durability or Maximum Strength.

No. 1 Common southern yellow pine, as defined in the "Timber Rule" book of the Southern Pine Association, March 15, 1916. To be dressed to standard sizes conforming to the rules of that Association.

FOR SOUTHERN YELLOW PINE HEAVY FACTORY AND LAMINATED FLOORING.

(5) When Durability and Maximum Strength Are Required.

"Dense" southern yellow pine of "merchantable grade" as defined in the "Timber Rule" book of the Southern Pine Association (March 15, 1916). To be dressed to standard sizes conforming to the rules of that Association and branded in accordance with the official requirements of that Association.

(6) When Strength Is Required Without Reference to Durability.

Southern yellow pine of "No. 1 Common Timbers" as defined in the "Timber Rule" book of the Southern Pine Association (March 15, 1916). To be dressed to standard sizes conforming to the rules of that association.

Note.

In lieu of the branding of timber above specified, the contractor may at his option arrange to have all material furnished under this specification inspected by the Inspection Department of the Southern Pine Association, in which event the contractor shall furnish and deliver to the architect a certificate showing that all material delivered complies with the architect's specifications. The entire expense of said inspection must be paid by the contractor.

Reinspection.

Should the architect demand that any material delivered be reinspected the said inspection shall be made by the official Inspectors of the Inspection Bureau of the Southern Pine Association or Lumbermen's Association of Chicago. Should ninety-five per cent (95%) or more of the material inspected be approved as complying with the grade specified, the inspection fee shall be paid by the owner. Should five per cent (5%) or more of the material inspected be rejected by the said Inspector as not complying with said grading rules, all inspection fees shall be paid by the contractor.

STANDARD SPECIFICATIONS FOR GRADES OF SOUTHERN YELLOW PINE FLOORING MARCH 15, 1916.

No. 1 COMMON FLOORING is the combined grade of C and D Flooring, and will admit all pieces that will not grade "B," and are better than No. 2 Common.

No. 2 COMMON FLOORING admits all pieces that will not grade as good as "D" flooring that can be used for cheap floors without a waste of more than one-fourth the length of any one piece. (See Sec. 26.)

No. 1 COMMON FACTORY FLOORING will admit of sound knots not over one-half the cross-section of the piece at any point throughout the length; pitch pockets, sap stain, shakes that do not go through, firm red heart, seasoning checks which do not show an opening through the piece, wane one-fourth inch deep on the face, a limited number of pin worm holes well scattered, loosened or heavy torn grain or other machine defects which will lay without waste. and pith knots which will not cause a leakage of grain. (See Secs. 35 and 123.)

"A" FLAT FLOORING must be practically free from defects on the face side and well manufactured.

"B" FLAT FLOORING will admit any two of the following or their equivalent of combined defects: 15 per cent. sap stain, 15 per cent. firm red heart, three pin knots, one standard knot, three small pitch pockets, one standard pitch pocket, one standard pitch streak, slight torn grain, small seasoning checks, six pin worm holes.

"C" FLAT FLOORING will admit any two of the following defects or their equivalent of combined defects: 25 per cent. of sap stain, 25 per cent. of firm red heart, two standard pitch streaks; medium torn grain, or other machine defects that will lay without waste; slight shake that does not go through, or seasoning checks that do not show an opening through, two standard pitch pockets, six small pitch pockets, two standard knots or six pin knots, twelve pin worm holes.

EDGE GRAIN FLOORING shall take the same inspection as Flat Grain, except as to the angle of the grain. (See Sec. 23.)

HEART FACE EDGE GRAIN shall be free from sap on face side.

"D" FLAT FLOORING will admit the following defects or their equivalent of combined defects: Sound knots not over one-half the cross section of the piece in the rough at any one point throughout its length; three pith knots, pitch, pitch pockets, sap stain, firm red heart, seasoning checks that do not show an opening through, shake that does not go through, a limited number of pin worm holes well scattered, loosened or heavy torn grain, or other machine defects that will lay without waste.

Pieces otherwise as good as "B" Flooring may have one defect (like a knot hole) that can be cut out by wasting 1½ inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

HEATING AND VENTILATION

Edited by Fred J. Postel, Mech. Engr.

HEATING.

In considering the installation of a heating system, the architect or engineer in almost every instance has his choice of three types, namely, steam, hot water and hot air. Both steam and hot water systems are fundamentally the same in principle regardless of the size of the installation, although, of course, there are modifications and variations in the application, to meet local conditions.

In hot air heating installations the smaller installations are almost always gravity systems, while the larger installations are almost always mechanically operated systems, i. e., the air is moved by means of fans.

As a matter of convenience, we may divide heating systems into two general classes, those using piping and radiating surfaces (steam and hot water systems) and those using ducts (hot air furnaces and hot blast systems).

STEAM VS. HOT WATER:

Before taking up the systems of the first class in detail, it may be well to consider some of the outstanding advantages and disadvantages of each. To simplify the discussion, the simple gravity system of each type is referred to in this comparison. Numerous improvements and modifications have been developed for both steam and hot water systems in order to gain some of the advantages of the other system. These naturally involve the installation of devices more or less automatic, but all requiring a certain amount of attention to keep them in operation. The question of whether the advantage gained warrants the expenditure both in first cost and in operation and maintenance, will depend on local conditions and no general rule will apply.

Generally speaking, the advantage of the steam over hot water is lower first cost, smaller radiators and smaller piping. The principal disadvantage is the fact that the temperature of the radiating surface cannot be regulated to meet the demands of the weather conditions. Again, the system is operative only so long as there is pressure in the mains. If the pressure is allowed to fall to atmosphere, circulation ceases, and the building is, to all intents and purposes, without a heating system, even though there is a smoldering fire in the furnace.

The advantage of the hot water heating system is that the temperature of the water may be varied with the demands of the service. With a properly designed system the water circulates at a very low temperature, so that a smoldering fire will produce sufficient circulation in mild weather. This feature makes it possible also to continue heating the building after the fires have been banked for the night.

The principal disadvantages of a hot water system are the greater first cost, larger radiators and piping, and the ever present possibility of damage to decorations and furnishings, as a result of a leak in the system.

The "vapor" system of steam heating and the so-called "modulation" system, both provide excellent means of temperature regulation and in this respect approach the advantages of a hot water system.

On the other hand, to overcome the disadvantage of large, ungainly radiators and piping in hot water systems, various devices have been developed to increase the temperature of the water under conditions of extreme demand. These systems depend on increasing the pressure on the water above atmosphere and are what may be referred to as closed systems, either wholly or in part.

STEAM HEATING.

In designing a system of steam heating, it should first be determined whether the conditions will be best met by a gravity, or a vacuum system.

In a gravity system, the mains and radiating surface are so laid out that all condensation returns to the boiler by gravity and no machinery is required to keep the system in operation. This system is necessarily operated at a pressure above atmosphere so that the pressure in the radiators is sufficient to expel the air from the system.

Practically all the vacuum systems being installed today remove the condensate and the entrained air through the same pipe. Another type of vacuum system in which each heating unit was provided with an air valve and these valves connected to a vacuum pump was in quite general use some years ago but is seldom used now.

The term "vacuum system" as used in this discussion will be taken to mean a system in which each individual heating unit is provided with a thermostatic or float type of trap and the condensate and air removed through a system of piping by means of a vacuum pump. In this connection it may be stated that in the case of large installations in which a group of buildings is sup-

plied from a central heating plant, the plan is frequently adopted of laying out the system in each buiding as a gravity job; providing one large trap for the entire building and discharging this trap into return mains connected to a vacuum pump. In such a system each building rather than each radiator is treated as a unit. Such a system is not, however, what is ordinarily meant by the term "vacuum" system.

In determining whether the expense of a vacuum system is justified by the conditions, the advantages to be obtained by using it must be carefully considered. The two things which make a vacuum system better than a gravity system are, first, circulation at a lower pressure; second, quick circulation when new radiation is turned on. The former is of particular importance in cases where the exhaust steam from engines is used to heat the building. The efficiency of the engine is increased as the back pressure is decreased. Therefore, the use of a vacuum system may be the means of saving considerable coal. On the other hand, the installation of a vacuum system cannot be justified from the standpoint of economy in coal consumption, if the demand for exhaust steam is so heavy that live steam must be used to make up the deficiency, even with the engine running against a back pressure.

Vacuum systems are sometimes installed where there are no engines and where the system might as well operate at 5 lbs. as at ½ lb. back pressure. The net cost of operating such a system is necessarily greater than would be the case in a gravity system and the only advantage is a somewhat freer circulation, and the fact that the radiators will heat up promptly when the inlet valves are opened.

While the cost of thermostatic or float vacuum valves adds materially to the cost of a vacuum system installation, this increased cost is offset, to a certain extent, by the fact that smaller pipes may be used in a vacuum system than in a gravity system.

A well laid out gravity system of ordinary size should circulate freely with one pound pressure under all ordinary conditions and with not to exceed two pounds pressure in extreme cold weather, when the demand for steam and therefore the velocity of the steam in the pipes reaches a maximum. A vacuum system should not require to exceed one-half to one pound pressure under any conditions.

A gravity system may be either a "one-pipe" or a "two-pipe" system and either of these may be an "up-feed" or a "down-feed" system. Except in the case of very high buildings equally good results can be obtained with either up-feed or down-feed, but where the building is very high there is an advantage in having a down-feed system.

A vacuum system may be either up-feed or down-feed, but will always be a two-pipe or a three-pipe system. The wet vacuum system is always necessarily a two-pipe system. The dry vacuum system when used in connection with cast iron radiation is usually a two-pipe system, the vacuum pipe being a very small pipe with probably ¼-inch branches and a main seldom larger than one inch. Where the dry vacuum system is applied to a coil system of heating in which the steam and returns are separate, the vacuum pipe will be required in addition to the other two, thus making a three-pipe system. As previously stated, the dry vacuum system is now very seldom used.

Inasmuch as the loss of heat from buildings is by radiation and conduction from walls, windows, roof and floor, and by the air which must be replaced by fresh outdoor air for ventilation, heating formulae must necessarily involve the quantities: area of exposed wall, roof and floor, area of glass (including doors) and the cubical contents. Wind exposure and the directions of the compass must also be considered.

Loss of heat through walls, roof, and floor depend upon the construction, the thickness, and the materials used as well as the difference in temperature between outside and inside surfaces.

There are a great number of heating formulae in use and it is seldom that the results figured by these various formulae will agree. The formulae are all empirical formulae and are based on average conditions. If the conditions of any particuar case vary considerably from the average, it is quite likely that none of the formulae will give correct results. To illustrate why there is often a wide variation in the amount of radiation calculated as being necessary for a certain installation, let us take the one factor of air changes. Generally speaking, we assume one air change per hour for a room. However, there may be some good reason for assuming that the windows will be open slightly or that for other reasons the room will have two air changes per hour. Obviously the required radiation for the two assumptions will be radically different.

The application of any of the formulae, after all, depends on the architect's or engineer's knowledge of the exact conditions likely to prevail and the factors which should be used for those conditions. In the last analysis, therefore, it is principally a matter of judgment on the part of the designer as to what constants are applicable.

The Chicago Master Steam Fitters' Association have compiled rules for computing radiating surface, published elsewhere in this volume, which will meet the average conditions quite satisfactorily.

PIPE SIZES:

One of the most common scources of error in designing a heating system is in the selection of proper pipe sizes. The cause is probably the fact that some designers fix the sizes according to tables without regard to local conditions. The size of a steam main is determined by the quantity of steam passing through it, the pressure of the steam, and the permissible friction loss. The length of the main is, of course, a factor in the latter item. Thus, it is permissible and good practice to use higher velocities in short mains than in long mains and likewise where the initial steam pressure is four or five pounds and a friction loss of two or three pounds not objectionable, much higher velocity may be used than in designing a system which is expected to circulate with steam at one pound pressure. The proper method of designing steam mains is to determine the initial pressure and the permissible friction loss and then figure the main to produce this loss at the assumed pressure.

In the design of return mains we have substantially the same conditions as in the design of the steam mains and in addition the item of allowable pitch. Where it is

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possible to give return mains considerable pitch they may, of course, be smaller than where they are run more nearly level.

The following table of pipe sizes is based on gravity systems, with short mains, operating at a pressure of from one to three pounds. It is a convenient reference for the conditions on which it is based, but, of course, must not be assumed to fit other conditions.

Radiation up to	One Pipe Work	Two Pipe Work
100 sq. ft........	1¼"	1 "x ¾"
200 sq. ft........	1½"	1¼"x ¾"
400 sq. ft........	2 "	1½"x1 "
600 sq. ft........	2½"	2 "x1 "
900 sq. ft........	3 "	2½"x1¼"
1,400 sq. ft........	3½"	3 "x1¼"
2,000 sq. ft........	4 "	3½"x1½"
3,300 sq. ft........	5 "	4 "x2 "
4,500 sq. ft........	6 "	5 "x2 "
7,000 sq. ft........	7 "	6 "x2½"
9,000 sq. ft........	8 "	7 "x3 "
11,000 sq. ft........	9 "	7 "x3 "
15,000 sq. ft........	10 "	9 "x4 "
24,000 sq. ft........	12 "	10 "x4 "

For vacuum systems the figures for "Two pipe work" may be reduced one pipe size.

HOT WATER HEATING.

In hot water heating the system may be a one-pipe or two-pipe system, or may be a gravity circulation system or a forced circulation system.

The gravity circulation system is dependent for circulation upon the fact that cold water is heavier than hot water. Therefore, the pitch of supply line should be upward from the boiler (which is the reverse of the requirement in steam heating) and the return should pitch downward toward the boiler as is the case, also, in steam heating.

In forced circulation systems which must usually be used when long horizontal runs are encountered, as is the case in factory heating, where the boiler or source of heat is in a detached power plant, a pump is used.

In one-pipe systems the radiators are connected in shunt with the supply lines, that is, the water to a radiator is taken from supply line, passes through radiator and is returned to supply line at a point further along in the direction of the travel of the water. Special fittings are sometimes employed in the diversion of the water into the radiators, especially in the case of forced circulation systems.

Two-pipe systems, especially in gravity circulation systems, may be considered to have more positive circulation.

Either one-pipe or two-pipe, gravity or forced circulation systems may be closed or open systems, though closed systems are not frequently found except in larger forced circulation systems. In either system an expansion tank must be used because of the expansion of water as its temperature rises.

The formulae which are used in estimating the amount of radiating surface required for steam heating may be used for computing the amount of radiating surface required for hot water heating, providing a factor dependent upon the difference in temperature of the hot water and of the steam is introduced.

SIZE OF HOT WATER MAINS.

(For gravity circulation and low buildings.)

Size of Main	Area	Direct Radiation Will Supply, Feet	Indirect Radiation Will Supply Feet
1½ in.	2.03	200	135
2 in.	3.35	325	200
2½ in.	4.78	450	300
3 in.	7.38	700	450
3½ in.	9.82	900	600
4 in.	12.73	1200	800
4½ in.	15.93	1500	1000
5 in.	19.99	2000	1200
6 in.	28.88	3000	2000
7 in.	38.73	4200	2800
8 in.	50.03	5600	3600
9 in.	63.63	7000	4600
10 in.	78.83	8500	5600

In forced circulation systems it is considered good practice to so proportion mains and returns that velocity of water will not exceed 200 feet per minute.

Carpenter gives as a practical rule, applicable when main and supply do not exceed 200 feet in length, "The diameter of main supply or return pipe in a system of direct hot water heating should be one pipe size greater than the square root of the number of square feet of radiating surface, divided by 9 for the first story, by 10 for the second story and by 11 for the third story of the building. For indirect hot water, multiply above by 1.5".

BOILERS FOR HEATING SYSTEMS.

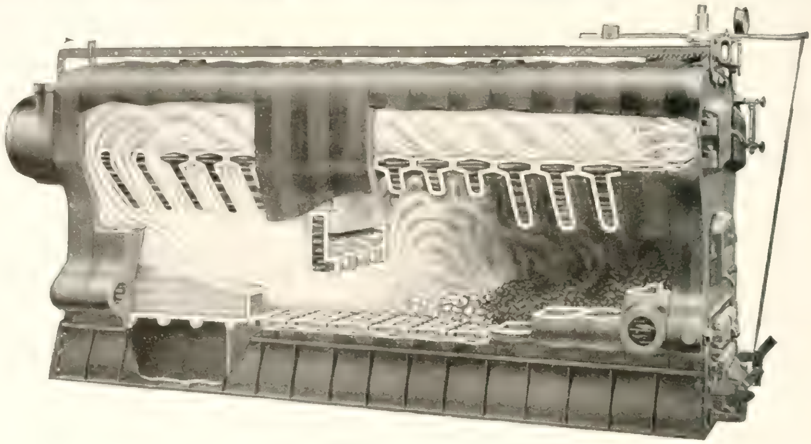
Boilers sold for heating installations are rated by manufacturers in square feet of radiating surface, which they will supply. Comparison of boilers sold by different manufacturers discloses the fact that boilers of different makes, having the same amount of heating surface have widely different ratings, as given by the manufacturers; the difference being in some cases nearly 100 per cent.

The capacity of a boiler depends on the form and extent of the heating surface, the water and steam space and upon the amount of grate surface.

Another factor to be considered is the question of whether the boiler is to be installed in a large plant with a fireman constantly on duty and firing at regular intervals, or whether the boiler is to be used in a small installation where it is desirable to have a boiler of sufficient size to permit intermittent firing and even banking for periods of several hours while carrying the connected load.

Power boilers are usually rated at from 7½ sq. ft. to 12 sq. ft. of heating surface per boiler horse power. On account of the difference in the method of firing, a heating boiler should have not less than 15 sq. ft. of

Imperial "Super-Smokeless" Boiler



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heating surface per rated horse power. Roughly 100 sq. ft. of radiation requires one boiler horse power.

SIZES OF CHIMNEYS:

The size and height of chimneys will depend on the kind and amount of coal burned; the kind of grate; the type of boiler and also on the location of the chimney relative to surrounding buildings. The latter is of great importance. A chimney which would be of sufficient height out in the country, where it extended above all surrounding buildings, might be totally inadequate in a city where it would be "blanketed" by high adjoining buildings.

In general, however, assuming a short straight breeching; a chimney smooth on the inside, reasonably tight and extending above surrounding buildings; and a good grade of bituminous coal used as fuel, the following sizes will be found ample:

Sq. Feet of Direct Steam Radiation	Horse Power	Size of Chimney	Sq. Feet of Direct Water Radiation
250	2.5	8″x 8″x25′	400
500	5.0	8″x12″x30′	850
800	8.0	12″x12″x35′	1350
1400	14.0	12″x16″x40′	2400
2200	22.0	16″x16″x50′	3700
3500	35.0	18″x18″x60′	5900
5500	55.0	20″x20″x70′	9300
8000	80.0	24″x24″x80′	13000

HOT AIR HEATING

In this classification is generally included the hot air furnace, the hot blast system and indirect steam radiation. The direct-indirect radiation might be included either under this head or under piping and radiator systems.

The hot air furnace is the simplest and usually the most effective of all the various heating systems, but its application is limited to buildings which do not require long horizontal ducts. It is well adapted to small one or two-story residences which do not cover much ground area and in which the furnace can be located in the center of the basement. The hot air furnace has the advantage of low first cost; is efficient in operation, and if properly operated provides better ventilation than either a steam or hot water system. The heating system is in operation almost from the moment a fire is started in the furnace. As soon as the air surrounding the fire pot becomes heated it starts to circulate. A hotter fire increases both the temperature and the volume of the circulating air. This system is, therefore, well adapted for wide ranges of outdoor temperature.

The principal disadvantages of the hot air furnace are the dust and dirt which are carried into the rooms, and the difficulty which is frequently found of maintaining a uniform temperature throughout a building, especially on windy days. Hot air furnaces are seldom air tight and as a result the gas from the combustion chamber as well as dust and dirt enter the air space around the fire pot and are carried up into the rooms through the ducts. The difficulty of maintaining uniform temperatures can be greatly reduced if the system is well designed, particularly with reference to exposure and prevailing winds.

A further objection to the hot air furnace is the fact that the air for heating passes over the surfaces which are heated directly by the flames and which at times may become almost red hot. Dust particles carried in the air are burned as they come in contact with the hot iron surfaces. This produces an offensive fine dust ash, which not only is very noticeable by its odor, but which irritates the nasal membranes.

Hot air furnaces should always be provided with a fresh air supply duct leading outdoors and a recirculating air duct leading to a hallway or other part of the building to which the various rooms connect. Both ducts should have control dampers so that the proportion of fresh outside air and of recirculated air may be regulated, as required by the number of occupants in the building.

Furnaces should also be equipped with water pans in the heated air compartment, to maintain proper humidity. These pans are sometimes placed near the bottom of the air chamber and are consequently surrounded by the cold air, making them very much less effective.

Warm Air Furnace Heating Plant Design follows the same rules in the method of computing its requirements as are heretofore set forth in connection with the discussion on steam and hot water heating.

A simple rule for computing sizes of hot air ducts for furnace systems is as follows: Determine the square feet of radiation that would be required if the room were to be heated by direct steam radiation; multiply this figure by the factors E and F determined from the following tables. The result will be the square inches of area of a round duct required to heat the room. This size may have to be increased or decreased slightly for special conditions:

Let **E** equal factors for exposure, the following table gives approximately correct estimates of proper values for **E**:

North	exposure	E=1.4
East	"	E=1.
N. E.	"	E=1.2
South	"	E=1.
S. E.	"	E=1.
West	"	E=1.4
S. W.	"	E=1.2
N. W.	"	E=1.4

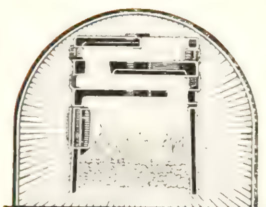
Let **F** equal factor for story location in the case of the gravity system only, then for:

First	story	**F**=1.4
Second	"	**F**=1.2
Third	"	**F**=1.0

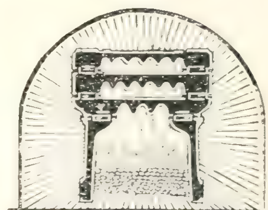
Inasmuch as the system is operated by discharging air into a room, it follows that a nearly equal amount of air has to be taken from the room. There will be some leakage, and as the air leaving the room is cooler there will be less cubic feet of air leaving the room than entering. Where it is probable that a room will be closed off most of the time, a return duct should be installed connecting either to the basement or to that part of the building where the recirculating register is located. In short, circulation is essential to satisfactory operation and some provision must be made to secure this circulation.

Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS

(ROUND TYPE) (ROUND TYPE)



Long "back and forth" fire travel holds hot gases in contact with heating surfaces~



Crown Sheet Section directly above fire, and other sections are corrugated to increase heating surface.

The illustration in center above shows a 5 Section Round Type Weil-McLain Boiler with sections separated Note the corrugated heating surface. Complete catalog gladly sent upon request.

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BLAST SYSTEMS:

Blast systems of heating are essentially the same as simple furnace systems except that the air is moved by a fan. The system is, therefore, much more positive. The air may be heated either directly in a furnace or by being blown or drawn over radiating surfaces heated by steam or hot water. Systems in which the air is heated by radiating surfaces heated by steam are by far the most common.

The size of the ducts is governed by the amount of friction loss permissible and, therefore, by the velocity of the air and the length of duct. Duct velocities vary over a wide range from 300 ft. to 1,500 ft. per minute. Where the power required to operate the fan is of minor importance, as for example, where the fan is driven by an engine which exhausts into the heating coils, high velocities are permissible. These may range from 600 ft. per minute in small ducts to 1,500 ft. per minute in large ducts. On the other hand, where the cost of power to drive the fan is important, it may be more economical to install larger ducts designed for velocities of from 300 ft. in small ducts to 1,000 ft. or 1,200 ft. as a maximum, in large ducts. Register velocities up to 600 ft. per minute are permissible where the register is located near the ceiling. Velocities above 600 ft. are likely to produce objectionable noise. Where the register is located near the floor, velocities as low as 150 ft. to 250 ft. per minute may be necessary in order to avoid objectionable drafts.

The velocity through exhaust registers even though located at the floor, may usually be as high as 400 ft. to 500 ft. per minute, and sometimes, depending on the location, as high as 600 ft. per minute.

The term "indirect heating" is usually applied to the system in which steam or hot water radiation is installed in a compartment or chamber under the floor and outside air permitted to pass over this radiation and into the room to be heated through duct and register. It is, therefore, very similar to the hot air furnace heated by steam or hot water is used instead of radiating surface heated directly by the flames.

The so-called "direct-indirect" system has the radiators in the room to be heated, connected with the outdoor air so that the air passing over the radiator is a mixture of fresh outdoor air and air circulating in the room.

Both of these systems have the advantage that they introduce some fresh air and to that extent are desirable from a ventilation standpoint. However, they meet the situation only part way, because the amount of air supplied to the room is usually determined by the outside temperatures rather than by the ventilation needs of the room.

HEATING BY ELECTRICITY.

Heating by electricity is entirely feasible and practical where the cost of electric current is very low. At the ordinary prevailing rates, however, the cost is prohibitive. The reason for this is that where electricity is generated in a steam plant using simple engines, only about 7% of the B. T. U. in the steam is delivered to the switchboard in the form of electrical energy. In stations where the highest type of generating apparatus is used, this percentage may be increased to 20%.

While the large power boiler is more economical in the production of steam than the small heating boiler, the fact that only 7% to 20% of the steam generated by the large power boiler is available as electrical energy makes the cost of this form of heating prohibitive.

TABLE OF EQUIVALENT TEMPERATURE FOR TESTING A HEATING PLANT AT DIFFERENT OUTSIDE TEMPERATURES.

For the purpose of indicating the efficiency of the apparatus for any specified condition, Prof. Carpenter gives the following table, which has been generally accepted as the standard test.

For steam, the radiator temperature in all cases is assumed to be that due to a pressure of 3 pounds at the boiler, or about 220° Fahr.

For water, the radiator temperature is assumed in all cases to be at an average of 160° Fahr.

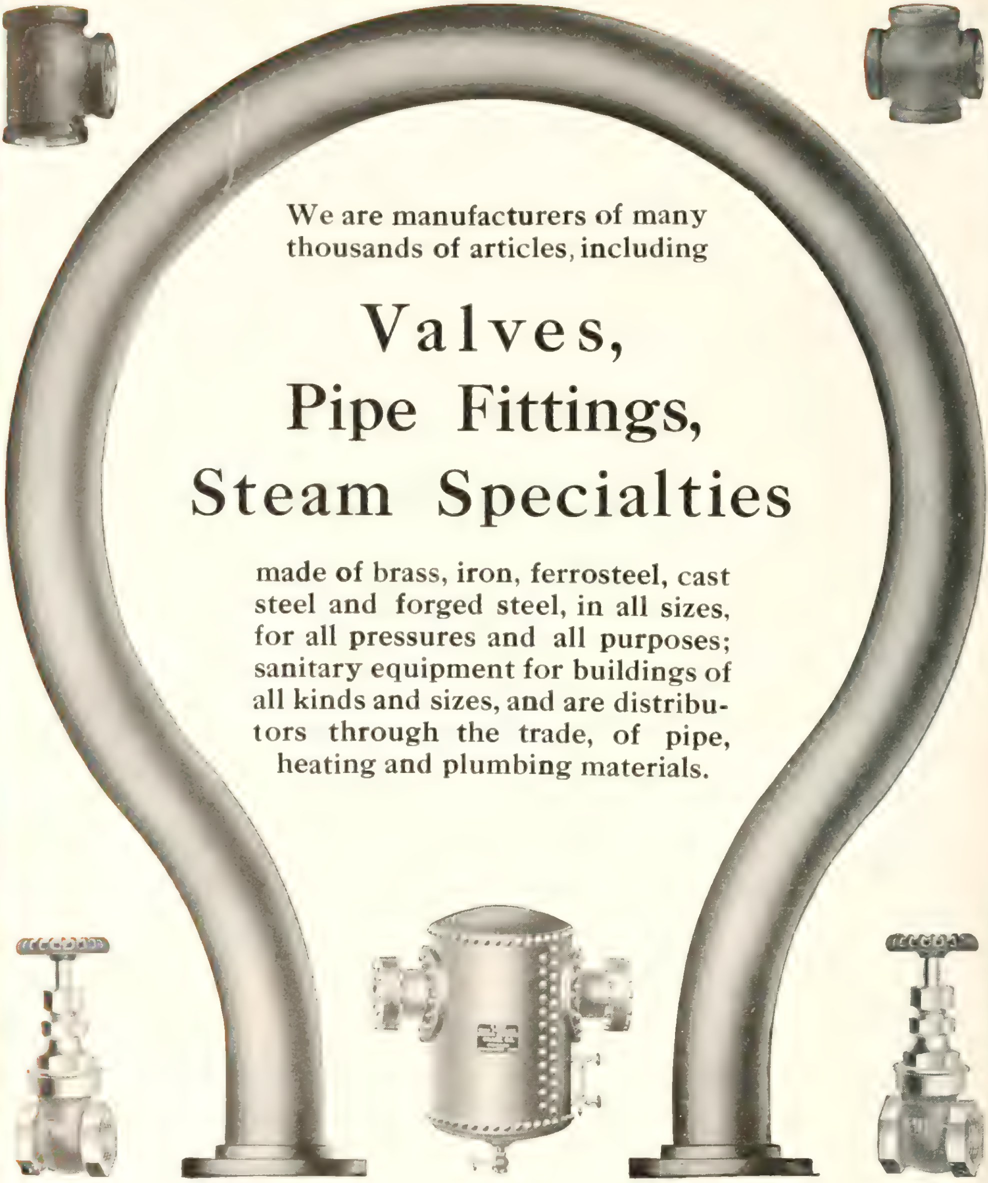
For a plant proportioned sufficiently to maintain a temperature of 70° when the outside temperature is at zero.

Temperature of Outside Air	Room should be raised to
—10	64.7
0	70.0
10	75.1
20	81.0
30	86.5
40	93.1
50	98.7
60	104.7
70	110.5
80	117.1
90	123.5
100	130.3

See University of Illinois Engineering Experiment Station Bulletin No. 31 for methods and results of tests on house heating apparatus. These tests have been made on different kinds of house heating apparatus with different kinds of fuel. The bulletin embodies the results of about three hundred tests. These bulletins are for free distribution.

VENTILATION.

The term ventilation, when used in the ordinary sense is a purely relative term. Every room or building, unless it is her-



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metically sealed is "ventilated" to a certain extent. A room heated with steam or hot water direct radiation and with all the windows and doors closed is ventilated by the amount of air leakage, due to the fact that neither the doors nor windows nor even the walls are air tight and there is a constant tendency for the interchange of air from the outside to the inside of the building. With the indirect system of heating, fresh air from the outside is introduced at a definite point and by means of a system entirely under control at all times.

The ducts supplying the air to the indirect radiation are usually provided with dampers, so that the amount of fresh air can be absolutely regulated. From the standpoint of ventilation, indirect radiation is far superior to direct radiation, but on account of the very much greater cost of operation, the amount of indirect radiation is usually restricted to one or two stacks in the ordinary residence.

In laying out any system of ventilation it is necessary to decide first of all on the standard of purity to be maintained. Pure country air contains about four parts of CO2 in 10,000. This amount of CO2 can be increased to 6, 8 and even 10 parts without any bad results to the occupants of the room. Naturally there is no sharp, well defined line above which ventilation is totally bad or below which the ventilation may be referred to as absolutely good. As a general proposition, it may be said, however, that a system of ventilation which permits the CO2 to rise above 12 parts in 10,000 is not a good modern ventilating system, while on the other hand, for commercial reasons, it is seldom that an attempt to keep the air purer than 6 parts of CO2 in 10,000 is made.

It should be clearly understood that the mere presence of CO_2 in such quantities as 12 parts in 10,000 is not in itself harmful. An artificial mixture of fresh country air and sufficient CO_2 to bring the total up to 12 parts of CO_2 in 10,000 would not be in the least injurious. On the other hand, when the air in a room is re-breathed until the CO_2 content reaches 12 parts of CO_2 in 10,000 then that air will contain enough harmful impurities thrown off by the lungs to make it offensive and impure.

The CO_2 content then is an indicator of the purity of the air only when this CO_2 has been thrown off in the breath of persons or animals. In that case, however, it indicates not only the relative purity of the air, but also the air movement or air change at that particular point.

In calculating the probable impurities, it may be assumed that the ordinary person in average good health, exhales 0.6 of a cubic foot of CO2 per hour and a "5-foot" gas burner vitiates about five times as much air as the ordinary person. A gas grate or any open fire-place, on the other hand, has a tendency to improve the ventilation; for while it uses up oxygen, it must be kept in mind that all the gases which pass up the chimney, must in the natural course of events be replaced by fresh air through the doors and windows.

As incandescent electric lights use up no oxygen, they have no effect on the ventilation of a room. In hospitals the amount of fresh air required for occupants is naturally much greater than in buildings occupied by persons in good health. The amount of fresh air per occupant must be doubled and some times trebled to maintain the required standard of purity.

The Chicago Commission on Ventilation in their report for 1914, says:

"However satisfactory the quantity of air furnished for the ventilation of a room, and however satisfactory may be the means employed for properly distributing it, both of which in the long run are very important, nevertheless the human body makes an immediate demand which may overshadow either or both. IMMEDIATE PHYSICAL COMFORT IS THE STANDARD OF THE HUMAN BODY, whatever the consequences, as exemplified either in the drowsy stupor that descends on one immersed in a hot, stifling atmosphere on a cold wintry night, or in the quiet reposé that comes from a balmy summer breeze outdoors. Good ventilation shall produce immediate comfort.

One of the most prominent as well as immediate factors in the production of comfort, is temperature. * * *

The comfort of the human body is largely influenced by the temperature of the surrounding air, and also, and at the same time, by the rate at which perspiration may evaporate into the air from the body. Relative humidity influences the rate at which such evaporation occurs, but it is only in recent years that much consideration has been given to atmospheric humidity in relation to temperature and comfort."

TEMPERATURE AND HUMIDITY IN RELATION TO COMFORT.

"It has become traditional in this country that the best temperature to maintain in a room is 68 to 70 degrees. There are, however, some who urge that these temperatures are too high, and they cite the English practice of 59 to 62 degrees as evidence of their claim. The difficulty with both these positions is that in deciding on the best temperature, proper consideration is not given to relative humidity. Any adult knows that sultry days are much less comfortable than days of even higher temperature when the atmosphere is comparatively dry. This well-known fact of outdoor experience must be taken into account, especially since it is now recognized that in cold weather we need to humidify air indoors. On this point of humidity, it may be said that the human organism seems to be adapted to a large range of relative humidity, but it is not accustomed to abrupt changes such as one might experience on a cold day in passing from the outdoors into a heated room. In a word, it seems important from the standpoint of health and comfort to maintain a fair degree of correspondence between the relative humidity of outdoors and indoors."

"Any system of ventilation to be practicable, must produce a feeling of comfort, and therefore both the temperature and the relative humidity of the air are important in ventilation. Temperature and relative humidity jointly help determine comfort."

"It has generally been considered that a temperature of from 68 to 70 degrees with a relative humidity of 70 percent, is a most desirable condition to obtain (the 70 percent relative humidity also is largely traditional).

In our tests it was assumed that the best temperature may or may not be 68 to 70 degrees; and also the most satisfactory relative humidity may or may not be 70 percent."

Ventilating systems may be divided into gravity and mechanical systems. Air can be moved into and from a room only by some form of power expenditure. When air is warmed, approximately one-third of the heat imparted to it is expended in work of expanding the air and is, in part at least, available for ventilating purposes.

In a gravity ventilating system, the working pressure is due to the difference in weight between the air inside and the air outside of the building or duct. This working pressure is much smaller than the pressures ordinarily used in a fan or mechanical ventilation system.

If the working pressure in a gravity ventilation system is small, the supply and discharge ducts must be made proportionately larger. The cross sectional area of these ducts is governed by the temperature of the air in the supply ducts and the highest outside temperature for which the vent ducts are provided. The cross sectional areas also are modified by the straightness and smoothness of ducts, the height of ducts and numerous other local conditions.

With indirect systems of heating, fresh air from the outside is introduced at definite points where indirect radiation is installed. The ducts supplying the air to the indirect radiation must be provided with dampers so that the amount of fresh air can be regulated. If they were not provided with dampers, the amount of air supplied in cold weather would be excessive and the cost of heating, therefore, would be too great.

The so-called mechanical ventilation systems are superior to gravity ventilation systems in that they require relatively small space for ducts and in the uniformity of ventilation secured, as they are independent of temperature or weather conditions.

The fan system of heating and ventilating is desirable from the ventilating standpoint to just the extent that fresh air is drawn from the outside. It should be understood that it is possible to operate a fan system, drawing the entire supply from the inside of the building. In this case, even though there is a movement of air, the ventilation is no better than with the ordinary direct radiation system.

Systems have been installed in which all the air is recirculated but passed through an air washer before being again delivered to the rooms. The theory is, that washing the air removes its objectionable qualities. There is a decided difference of opinion as to the merits of this system. At this time there is insufficient data at hand to either prove or disprove the claims made.

If all the air is taken from the outside, the combined heating and ventilating system will provide the very best of ventilation. In practice, for purposes of economy, fan systems are usually designed to take most of the air from the outside, but a by-pass is provided so that in extreme cold weather, part of the air can be drawn from the inside of the building.

Quite frequently a combination of a direct heating system and a fan ventilation system is used. In such cases the heating system is usually designed to supply the heat lost by radiation through walls, roof, floor and windows. The fan ventilating system is designed to supply sufficient air to maintain a predetermined standard of purity and is then provided with just sufficient radiation to heat this air to the room temperature.

AIR WASHERS:

The use of air washers in connection with fan vetilating systems, is almost always desirable and in most cases absolutely necessary, in order to assure a supply of clean, pure air.

All air washers consist primarily of a spray chamber in which the air is made to pass through a fine spray of water, and an eliminator or separator in which the water is separated from the air.

The movement of air, containing particles of dust and dirt, through a system of ducts is bound to cause a deposit of part of the impurities on the walls of the ducts. As it is next to impossible to clean the average ventilating duct, this, in time, becomes so dirty that no matter how clean the air leaving the fan, some dirt will be carried into the room through the fresh air registers. From this, it is evident that even though air washers do not remove all of the dust in the air, the use of an air washer improves a ventilating system by just the amount of dirt that the washer removes.

It should also be noted that air washers present a convenient means of increasing the humidity of the air.

BOILER AND PIPE COVERINGS.

Experiments under actual steam plant conditions, conducted by Geo. M. Brill (Trans. Am. Soc. Eng. Vol. XVI) show that in ordinary practice the early results and theories, advanced by Sir Isaac Newton and Peclet, are too low. He found that by using an 8 inch bare steam pipe 60 feet long with an average pressure of 110.5 lbs. by gauge, and with air 75.5 degrees Fahrenheit, that 736.546 B. T. U. per square foot of surface per hour, were lost. These results accord so closely

with the experiments conducted by Prof. R. C. Carpenter of Cornell University, and Prof. M. E. Cooley of the University of Michigan, that it seems fair to use these results as a premise of calculation in practical work. The magnitude of the loss from a bare pipe can be understood possibly more closely by the following calculation:

Adopt from Mr. Brill's results a loss of 736 B. T. U. per square foot of surface per hour and, assuming an 8-inch pipe to be 100 feet long, the loss would then be as follows:

736. B. T. U. multiplied by 225 square feet (surface of an 8-inch pipe 100 feet long) equals 165,600 B. T. U. lost per hour.

Dividing by 33,305, which is the number of heat units (B. T. U.) in one boiler horse power, equals 5 boiler horse power per hour lost. The method adopted for preventing in a measure this loss is by the application of some non-conducting material to the radiant body, having for its object the protection of the external surfaces from loss of heat and from any injurious action liable to occur in consequence of their exposure. It will therefore be seen that a great economy can be effected by the application of pipe covering or boiler lagging.

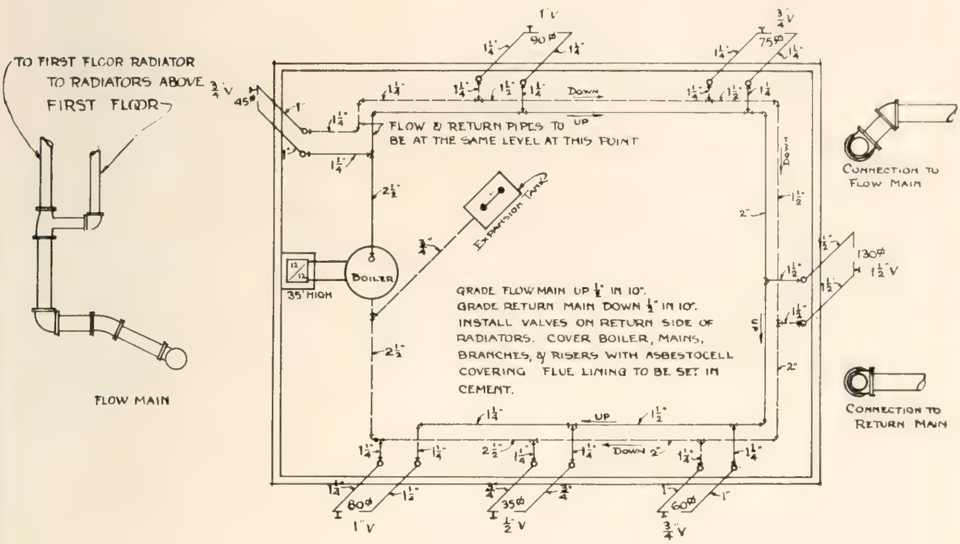
BOILER EFFICIENCY TABLE

Based on evaporation from and at 212° F.

B. T. U. Per Lb. Coal.	50% Efficiency		55% Efficiency		60% Efficiency		65% Efficiency		70% Efficiency		75% Efficiency		80% Efficiency	
	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.
7500	3.8	9.0	4.2	8.2	4.6	7.5	5.0	6.8	5.4	6.4	5.8	6.0	6.2	5.5
8000	4.1	8.4	4.5	7.6	4.9	7.0	5.3	6.5	5.7	6.0	6.2	5.5	6.6	5.2
8500	4.4	7.8	4.8	7.1	5.2	6.6	5.7	6.0	6.1	5.6	6.6	5.2	7.0	4.9
9000	4.6	7.5	5.1	6.7	5.5	6.2	6.1	5.5	6.5	5.3	6.9	5.0	7.4	4.6
9500	4.9	7.0	5.4	6.3	5.9	5.8	6.3	5.4	6.8	5.0	7.3	4.7	7.8	4.4
10000	5.1	6.7	5.6	6.1	6.2	5.5	6.7	5.1	7.2	4.7	7.7	4.4	8.2	4.2
10500	5.4	6.3	5.9	5.8	6.5	5.3	7.1	4.8	7.6	4.5	8.1	4.2	8.6	4.0
11000	5.6	6.1	6.2	5.5	6.8	5.0	7.4	4.6	7.9	4.3	8.5	4.0	9.1	3.7
11500	5.9	5.8	6.5	5.3	7.1	4.8	7.7	4.4	8.3	4.1	8.9	3.8	9.5	3.6
12000	6.2	5.5	6.8	5.0	7.4	4.6	8.0	4.3	8.6	4.0	9.3	3.7	9.9	3.4
12500	6.4	5.3	7.1	4.8	7.7	4.4	8.4	4.1	9.0	3.8	9.7	3.5	10.3	3.3
13000	6.7	5.1	7.4	4.6	8.0	4.3	8.7	3.9	9.4	3.6	10.0	3.4	10.7	3.2
13500	6.9	5.0	7.6	4.5	8.3	4.1	9.0	3.8	9.7	3.5	10.4	3.3	11.1	3.1
14000	7.2	4.7	7.9	4.3	8.6	4.0	9.4	3.6	10.1	3.4	10.8	3.2	11.5	3.0
14500	7.5	4.6	8.2	4.2	9.0	3.8	9.7	3.5	10.5	3.2	11.2	3.0	12.0	2.8

TWO-PIPE NON-SHORT CIRCUIT HOT WATER HEATING SYSTEM

HOMER R. LINN, Mechanical Engineer, Member American Society Heating and Ventilating Engineers



Gravity hot water heating systems may be divided into two general heads, viz.: Short circuit systems and non-short circuit systems. These may be subdivided into up feed, feed, down feed, etc.

In the non-short circuit system the flow return mains run parallel, grade up away from the boiler and are of corresponding sizes where any radiator is taken off. The first radiator taken off of the flow main is also the first radiator on the return main. We, therefore, have the greatest push or pressure on the flow main and the greatest pull on the return main at this point. The result is that the tendency of all of the hot water is to go through this radiator, while the one on the farther end of the main has less pressure and therefore is sluggish. Various means are resorted to in overcoming this air, such as putting lead washers in the valve unions, taking flow connection off of the side of the main, etc. Any of these are uncertain and often cause trouble which is hard to locate.

In the non-short circuited system the flow main grades up away from the boiler. Where the connection to the first radiator is taken off of the flow main, the connection from the return of this radiator is brought into the end of the return main. In other words, this is the smallest diameter of the return main. It will be seen that we have here the greatest push on the flow main and the least pull on the return main. At this point both mains should be on the same level, but from here on the return main should grade down one-half inch in ten feet, while the flow main should continue to grade up one-half inch in ten feet. The last radiator taken off of the flow main will be the nearest radiator to the boiler on the return main: Therefore, at this point we have the least push in the flow main but the greatest pull in the return main. Thus it will be seen we have no short circuits, but a balanced condition throughout. The accompanying sketch illustrates how the proper sizes of valves and pipes may be selected from the table. It also shows the best method of making connections to the flow main and also to the return main.

Unless boilers are furnished with integral metal insulating jackets, they should be well covered with a plastic covering having an air space between the boiler and the covering. All mains, branches and risers should be covered with a good grade of moulded covering. The expansion tank pipe may be taken off from either the flow or the return main, whichever is most convenient.

GRAVITY HOT WATER HEATING.

Sizes of mains for basement **two-pipe non-short circuit system** where mains are not over 100 feet long.

1¼"	pipe,	0	sq.	ft.	to	100	sq.	ft.
1½"	pipe,	101	sq.	ft.	to	250	sq.	ft.
2"	pipe,	251	sq.	ft.	to	400	sq.	ft.
2½"	pipe,	401	sq.	ft.	to	650	sq.	ft.
3"	pipe,	651	sq.	ft.	to	1000	sq.	ft.
3½"	pipe,	1001	sq.	ft.	to	1900	sq.	ft.
4"	pipe,	1901	sq.	ft.	to	2500	sq.	ft.
4½"	pipe,	2501	sq.	ft.	to	3100	sq.	ft.
5"	pipe,	3101	sq.	ft.	to	4000	sq.	ft.
6"	pipe,	4001	sq.	ft.	to	5600	sq.	ft.

Sizes of Risers.

¾"	pipe,	0	sq.	ft.	to	40	sq.	ft.
1"	pipe,	45	sq.	ft.	to	65	sq.	ft.
1¼"	pipe,	70	sq.	ft.	to	100	sq.	ft.
1½"	pipe,	105	sq.	ft.	to	175	sq.	ft.

Sizes of Valves.

½"	valve,	0	sq.	ft.	to	40	sq.	ft.
¾"	valve,	45	sq.	ft.	to	75	sq.	ft.
1"	valve,	80	sq.	ft.	to	100	sq.	ft.
1¼"	valve,	105	sq.	ft.	to	125	sq.	ft.
1½"	valve,	130	sq.	ft.	to	175	sq.	ft.

Stewart Warner Speedometer Corp., Chicago, Ill. L. G. Hallberg & Co., Architects
Twelve No. 120 Smokeless Boilers.

CHICAGO MASTER STEAM FITTERS' ASSOCIATION STANDARDS

For Computing Boiler Sizes and Radiation Quantities for Buildings of Average Construction.

RULE FOR COMPUTING RADIATOR QUANTITIES FOR HEATING PLANTS.

The following are rules compiled and recommended by the Chicago Masters Steam Fitters' Association. However, they should not control against the best judgment of the competent designing engineer.

Schedule for computing minimum quantities of steam radiation at 70° F. with outside temperature at minus 10° F.

1 foot of radiation for every 300 cubic feet of contents, plus

1 foot of radiation for every 15 square feet net exposed wall surface, plus

1 foot of radiation for every 2 square feet of single glass surface, plus

1 foot of radiation for every 4 square feet of double skylight.

For all rooms with plastered ceilings and unheated air space between ceiling and the roof, add 1 foot of radiation for every 30 square feet of ceiling area.

For all rooms with ceiling plastered on roof joist add 1 foot of radiation for every 20 square feet of ceiling area.

For all rooms with open joist roof construction add 1 foot of radiation for every 10 square feet of roof.

For all rooms having concrete roof add 1 foot of radiation for every 6 square feet of roof.

For all floors except wood construction having no basement or air space, 1 foot of radiation for every 30 square feet of floor area.

All bath rooms in living abodes to be heated to 80°.

For all rooms with northeast or northwest exposures add 10 per cent additional radiation.

Where radiators are placed under seats or behind grills add 20 per cent additional radiation.

Where radiators are placed in open recesses add 10 per cent additional radiation.

For indirect radiation without fan system add 50 per cent additional radiation.

For direct-indirect without fan system add 25 per cent additional radiation.

Where single pipe coils or single cast-iron wall radiation is placed on side walls 80 per cent of the required amount of standard column radiation may be installed. Size of boiler and piping, however, shall be based on standard column radiation requirements. Ceiling coils to be considered as standard column radiation.

In measuring glass surface the full opening in wall shall be figured. Outside door openings shall be taken as glass.

For computing minimum quantities of hot water radiation at 70° F. with outside temperature at minus 10° F., add 60 per cent to amount necessary for steam.

For computing minimum quantities for vapor systems at 70° F. with outside temperature at minus 10° F., add 20 per cent to amount necessary for steam.

A vapor system is defined as a two-pipe steam system which has the return lines open to atmosphere with no valve at the return connections of heating units which will close against steam.

For heating to temperatures other than minus 10° F. to 70° F. multiply actual amount of radiation required by the following co-efficients:

—10° to 80°	1.13	—10° to 55°	.81
—10° to 75°	1.06	—10° to 50°	.75
—10° to 70°	1.	—10° to 45°	.69
—10° to 65°	.94	—10° to 40°	.62
—10° to 60°	.87		

RULE FOR COMPUTING BOILER SIZES FOR DIRECT RADIATION

Schedule for computing minimum sizes of boilers for the average building based on approved ratings specified in the manufacturer's catalogue.

Steel tubular or steel water tube boilers 100 sq. ft. per horse power (A. S. M. E. code).

In computing boiler sizes for buildings heated to lower than —10° to 70° F. multiply the amount of cast iron column radiation necessary to maintain the required temperature by the following co-efficient before adding the percentage given in rule for computing boiler sizes.

	Steam.	Water.
—10° to 65°	1.03	1.05
—10° to 60°	1.07	1.09
—10° to 55°	1.10	1.13
—10° to 50°	1.13	1.18
—10° to 45°	1.17	1.24
—10° to 40°	1.20	1.27

RULE FOR COMPUTING BOILER SIZE FOR DIRECT-INDIRECT AND INDIRECT RADIATION

For computing boiler size for **direct-indirect** and **indirect** radiation, reduce same to basis of direct by adding 25 per cent to **direct-indirect** and 50 per cent to **indirect,** then use factor of safety as called for on direct radiation.

RULE FOR COMPUTING BOILER SIZES FOR HOT BLAST COILS

For computing boiler size to be used for Hot Blast Coils use manufacturers' condensation charts, and figure ¼ lb. of condensation per hour as equivalent to 1 square foot of direct radiation and add following factor of safety:

Fire-box, up-draft	10%
Fire-box, down-draft	15%
Portable	15%
Cast-iron, down-draft	25%
Magazine	25%
Cast-iron, up-draft	40%

Where coils are to be inserted in boiler or steam coils in hot water tank for heating water for domestic purposes, size of boiler should be increased, figuring each gallon of water tank capacity as equivalent to 2 sq. ft. of radiation. For example, a 160-gallon tank should be figured as equivalent to 320 sq. ft. of radiation plus factor of safety as indicated on boiler chart showing factors of safety.

The above schedules of quantities are commensurate with good heating results for the average building of average construction, but by no means to be construed as guarantees of the proper quantities of radiation or boiler sizes necessay to heat every building, as extraordinary conditions will of course require additional radiation or boiler capacity.

It is recommended in all installations of steam boilers that drain valves be placed on the returns and that the condensation from such returns be discharged into the sewer for a period of from three days to one week after starting fire, thereby clearing system of grease and dirt. At the end of this period boiler should be thoroughly washed and blown out.

EXAMPLE

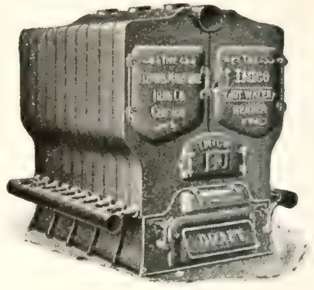
Find size of steel down-shaft brick set boilers required for the following installation (Key No. 7, Boiler Chart):

(1) 500 sq. ft. of direct cast iron column radiation in rooms to be heated from —10° to 70°.

(2) 500 sq. ft. of direct cast iron column radiation in rooms to be heated from —10° to 50°.

IMICO

House Heating Boilers



For Steam and Hot Water

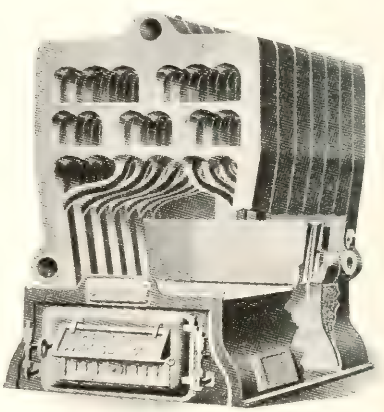
Low Ratings, Perfect Construction, Low Fuel Consumption, Unexcelled Efficiency

Illinois Malleable Iron Co.

1801-1825 Diversey Boulevard — CHICAGO

The PEERLESS single grate smokeless boiler is constructed so that the fire goes toward the crown sheet instead of from it (see cut). All PEERLESS sectional boilers have "S" water tubes in the fire pot.

Phone Wentworth 1920
for catalog



Weir & Craig Company

PLUMBING & HEATING SUPPLIES

6316 Wentworth Avenue

CHICAGO, ILLINOIS

(3) 500 sq. ft. of cast iron wall radiation or wall pipe coils (being the equivalent of 625 sq. ft. of cast-iron column radiation) in rooms to be heated from —10° to 50°.

(4) 500 sq. ft. of indirect radiation.

(5) 500 sq. ft. of direct-indirect radiation.

(6) 250 gal. hot water tank. Water to be heated with steam coils.

(7) 500 sq. ft. of cast iron hot blast radiation, regular sections, 5″ centers, 1,000 ft. velocity, air taken from out of doors —10° to F.T. 80. Radiation 3 stacks deep.

ANSWER

(1)	500 sq. ft.	500
(2)	500 sq. ft. + 13%	565
(3)	500 sq. ft. + 25% + 13%	707
(4)	500 sq. ft. + 50%	750
(5)	500 sq. ft. + 25%	625
(6)	250 gal. × 2	500
		3647
	Add factor of safety .378%	1378
		5025
(7)	500 × 1.92 × 4 + 15%	4416
	Minimum rated capacity of boilers	9441

SIZES OF LOW PRESSURE STEAM MAINS ONE PIPE CIRCUIT SYSTEM DRIPPED AT END

1″	up to 60 sq. ft.
1¼″	60 sq. ft. to 100 sq. ft.
1½″	100 sq. ft. to 200 sq. ft.
2″	200 sq. ft. to 400 sq. ft.
2½″	400 sq. ft. to 600 sq. ft.
3″	600 sq. ft. to 900 sq. ft.
3½″	900 sq. ft. to 1,400 sq. ft.
4″	1,400 sq. ft. to 2,000 sq. ft.
4½″	2,000 sq. ft. to 2,600 sq. ft.
5″	2,600 sq. ft. to 3,300 sq. ft.
6″	3,300 sq. ft. to 4,500 sq. ft.
7″	4,500 sq. ft. to 7,000 sq. ft.
8″	7,000 sq. ft. to 9,000 sq. ft.
9″	9,000 sq. ft. to 11,000 sq. ft.
10″	11,000 sq ft. to 15,000 sq. ft.
12″	15,000 sq. ft. to 24,000 sq. ft.

On all piping, proper provision shall be made for expansion and contraction.

All piping shall be properly pitched.

All horizontal branches more than 12 feet in length shall be increased 2 sizes.

All horizontal branches more than 16 feet in length shall be properly dripped.

Supply mains shall not be reduced more than one-half the diameter of the largest main.

Dry returns shall be not less than one-half the diameter of the supply.

Wet returns may be one size smaller than one-half the diameter of the supply pipe. By supply pipe is meant the size of the main at the point of leaving boiler.

PIPE SIZES FOR UP-FEED RISERS

1″	25 square feet or under.
1¼″	25 to 60 square feet
1½″	60 to 100 square feet
2″	100 to 200 square feet
2½″	200 to 350 square feet
3″	350 to 900 square feet
3½″	900 to 1,200 square feet
4″	1,200 to 2,000 square feet

RADIATOR CONNECTIONS

Up to and including 25 square feet	1″
Above 25 and including 60 square feet	1¼″
Above 60 and including 90 square feet	1½″
Above 90 square feet	2″

All horizontal connections to radiators shall be increased one size except branches for radiators from 91 to 130 square feet, which may be the same size as radiator connections.

All horizontal connections to risers shall be increased one size.

A New Factor in Building Valuations

It is felt that there is need for a new viewpoint in building valuation. In the past it would seem that too much stress has been placed on age and immediate revenue in building valuation. It would seem that the architect, owing to his peculiar training, is in a position to point out other very important factors entering into value make-up, which have not heretofore been considered in this locality; such as, balance of structural design, adaptability to purposes intended, character of construction as influencing cost of up-keep.

Feeling that the stability of building investment can be better assured by taking the before mentioned factors into consideration, the Illinois Society of Architects has appointed a Building Valuation Committee to furnish the public with competent architectural valuation service. This Committee should form a real asset to the community.

FULL AREA OF TWO-PANE WINDOWS

GIVING THE TOTAL AREA OF TWO-PANE WINDOWS, BRICK OPENING.

Height of Glass / Width of Glass	16″	18″	20″	22″	24″	26″	28″	30″	32″	34″	36″	38″	40″
	TOTAL AREA IN SQUARE FEET												
12″	5.9	6.4	7.	7.5	8.	8.6	9.2	9.8	10.2	10.9	11.4	12.	12.5
14″	6.5	7.1	7.7	8.3	9.	9.6	10.2	10.8	11.4	12.	12.6	13.2	13.8
16″	7.	7.7	.4	9.1	9.8	10.5	11.2	11.9	12.6	13.3	14.	14.4	15.
18″	7.6	8.4	9.1	9.8	10.5	11.2	12.	12.7	13.	14.1	14.8	15.6	16.3
20″	8.2	9.	9.8	10.5	11.3	12.1	12.9	13.7	14.5	15.2	16.	16.8	17.5
22″	8.8	9.6	10.4	11.2	12.1	13.	13.8	14.6	15.4	16.2	17.	17.8	18.8
24″	9.4	10.3	11.1	12.	12.9	13.8	14.7	15.6	16.5	17.4	18.3	19.2	20.
26″	10.	10.9	11.8	12.7	13.7	14.7	15.6	16.6	17.5	18.5	19.4	20.4	21.3
27½″	10.4	11.4	12.5	13.4	14.3	15.3	16.3	17.3	18.3	19.3	20.3	21.3	22.2
28″	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5
30″	11.1	12.2	13.2	14.3	15.4	16.4	17.5	18.5	19.6	20.6	21.7	22.7	23.8
32″	11.7	12.8	13.9	15.	16.1	17.2	18.4	19.5	20.9	21.7	22.8	23.9	25.
34″	12.3	13.5	14.6	15.8	17.	18.1	19.3	20.5	21.6	22.9	24.	25.2	26.3
36″	12.9	14.1	15.3	16.5	17.8	19.	20.9	21.4	22.7	23.9	25.1	26.3	27.5
38″	13.5	14.7	16.	17.3	18.6	19.9	21.1	22.4	23.7	25.	26.2	27.5	28.9
40″	14.	15.4	16.7	18.	19.4	20.7	21.6	23.4	24.7	26.	27.4	28.7	30.
44″	15.2	16.7	18.1	19.5	21.	22.4	23.9	25.3	26.8	28.2	29.7	31.1	32.5
48″	16.4	17.9	19.5	21.	22.6	24.2	25.7	27.3	28.8	30.4	31.9	33.5	35.

Sizes not shown, figure brick opening.

TABLE OF COMPARATIVE RATINGS AS COMPILED BY THE CHICAGO MASTER STEAMFITTERS ASSOCIATION

RADIATION LOAD

FACTOR OF SAFETY OVER RADIATION LOAD

Key	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
1	135	134	131	133	133	133	132	132	131	131	130	130	130	129	129
2	130	129	129	128	128	128	127	127	126	126	125	125	125	124	121
3	125	124	121	123	123	123	122	122	121	121	120	120	120	119	119
4	92	92	92	92	92	92	92	92	92	92	.92	92	.92	.92	.92
5	100	995	99	985	983	98	975	97	965	963	958	953	95	945	.94
6	68	68	68	68	.68	68	68	68	68	68	68	68	68	68	68
7	80	798	796	794	79	785	783	779	775	773	.77	.768	763	.76	758
8	75	745	74	735	73	725	72	715	71	705	.70	.695	69	685	68
9	65	645	64	635	63	625	62	615	61	605	60	.595	59	585	58
10	50	498	495	493	49	488	485	483	48	478	475	473	47	468	465
11	45	448	445	443	44	438	435	433	.43	428	425	423	42	418	415
12	40	398	397	395	394	393	391	39	388	387	.385	384	383	381	38
13	.35	.348	.347	345	.344	.343	.341	34	338	337	.335	334	.333	.331	33
14	.30	298	.297	.295	.294	.293	.291	29	.288	.287	.285	.284	283	281	.28

Key	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900
1	128	128	127	127	127	126	126	125	125	125	124	124	123	123	122
2	123	123	122	122	122	121	121	120	120	120	119	119	118	118	117
3	118	118	117	117	117	116	116	115	115	115	114	114	113	113	112
4	.92	92	92	92	92	.92	92	92	92	.92	92	92	92	92	92
5	.938	933	928	925	92	915	.913	908	903	.90	895	89	887	883	878
6	68	.68	68	68	68	68	68	68	68	68	68	68	68	68	68
7	.753	75	748	.745	743	738	735	733	729	725	723	72	717	713	71
8	675	.67	665	66	655	65	645	64	635	63	625	62	615	61	605
9	575	57	565	56	555	55	545	54	535	53	525	52	515	51	505
10	463	46	458	453	45	.448	443	44	438	435	433	43	428	425	423
11	.413	41	408	403	40	.398	393	39	388	385	383	38	378	375	373
12	378	377	.375	374	.373	.37	368	367	365	364	363	361	.36	358	.357
13	328	327	325	324	323	32	318	.317	315	314	313	311	31	308	307
14	.278	.277	275	.274	.273	.27	.268	.267	265	.264	.263	.261	26	258	257

RADIATION LOAD

FACTOR OF SAFETY OVER RADIATION LOAD

Key	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400
1	122	122	121	121	120	120	120	119	119	118	118	117	117	117	116
2	117	117	116	116	115	115	115	114	114	113	113	112	112	112	111
3	112	112	111	111	110	110	110	109	109	108	108	107	107	107	106
4	92	92	92	.92	.92	92	.92	92	.92	92	92	92	92	.92	92
5	.875	87	865	863	858	855	85	845	.84	.837	832	828	.825	.82	.815
6	68	68	68	68	.68	68	.68	68	68	.68	68	68	68	68	.68
7	707	703	70	.698	694	691	.688	685	682	.678	675	673	669	665	.663
8	60	598	596	595	.593	592	59	588	587	.586	585	583	581	58	.579
9	50	498	496	.495	.493	.492	49	488	487	.486	485	483	.481	48	.479
10	42	.418	415	.413	.41	.408	.405	403	40	.398	.395	.393	.39	388	.385
11	37	.368	365	.363	.35	.358	.355	.353	35	.348	.345	.343	.34	338	.335
12	.355	354	.353	.351	.35	.348	.347	.345	.343	.341	.34	.338	.337	335	.334
13	.305	.304	.303	.301	30	298	.297	295	.293	.291	.29	288	.287	285	.284
14	.255	.254	.253	.251	.25	.248	.247	.245	.243	.241	.24	.238	.237	.235	.234

Key	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900
1	116	115	115	114	114	114	113	113	112	112	112	111	111	110	110
2	111	110	110	109	109	109	108	108	107	107	107	106	106	105	105
3	106	105	105	104	104	104	103	103	102	102	102	101	101	100	100
4	92	92	.92	.92	92	92	92	92	92	92	.92	92	92	92	92
5	81	808	.803	.798	795	79	.787	.783	778	.773	77	765	76	758	753
6	68	68	.68	68	68	68	68	68	68	68	68	68	68	68	68
7	659	657	655	65	.648	643	64	638	634	63	628	625	623	619	615
8	577	575	574	573	571	57	568	566	565	564	.562	.56	559	558	555
9	477	475	474	473	471	47	468	466	465	464	462	46	459	458	455
10	383	38	378	375	373	.37	368	365	363	.36	358	355	353	35	348
11	.333	.33	.328	.325	323	.32	318	.315	.313	.31	308	305	.303	30	298
12	.333	331	33	328	.327	325	324	323	321	.32	318	317	315	314	313
13	283	.281	28	278	277	.275	274	273	271	.27	268	267	265	264	263
14	.233	.231	.23	.228	.227	225	.224	.223	221	22	.218	.217	.215	.214	.213

NOTE—No boiler to be installed having grate longer than 72".

RADIATION LOAD

Key	Factor of Safety over Radiation Load	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600
1		110	109	109	108	108	107	107	107	106	106	105	105	104	104	104	103	103
2		105	104	104	103	103	102	102	102	101	101	100	100	999	993	99	985	98
3		100	995	99	98	98	978	973	97	965	96	955	951	949	943	94	935	93
4		.92	.92	.92	92	.92	.92	.92	.92	.92	.92	92	.92	.92	.92	92	92	.92
5		75	745	74	.735	.73	.728	.723	.72	.715	.71	.705	.701	.699	.693	.69	.685	.68
6		.68	.68	68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.613	.608	.606	.603	.60	.596	.593	.59	.586	.583	.58	.578	.574	.57	.568	.563	.561
8		.554	.552	55	549	.548	.547	.546	.545	.543	.541	.54	.538	.536	.535	.533	.531	.53
9		454	.452	.45	449	.448	.447	.446	.445	.443	.441	.44	.438	.436	.435	.433	.431	.43
10		345	.343	34	.338	.335	.333	.33	.328	.325	.323	.32	.318	.315	.313	.31	.305	.30
11		.295	.293	.29	.288	.285	.283	.28	.278	.275	.273	.27	268	.265	.263	.26	.255	.25
12		.306	.304	.303	.301	.299	.298	.296	.295	.293	.292	.29	.289	.287	.285	.283	.282	.28
13		.256	.254	.253	.251	.249	.248	.246	.245	243	242	.24	.239	.237	.235	.233	.232	.23
14		.206	.204	.203	.201	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	20	.20	.20

Key	8700	8800	8900	9000	9200	9400	9600	9800	10000	10200	10400	10600	10800
1	102	102	101	101	101	100	100	997	993	99	988	986	985
2	975	973	969	965	96	955	95	947	943	94	938	936	935
3	925	923	919	915	91	905	90	897	893	89	888	886	885
4	.92	92	.92	.92	.92	92	.92	92	.92	.92	92	92	92
5	.675	.673	.669	.665	.66	.655	.65	647	.643	.64	.638	636	.635
6	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7	.558	.555	.551	.548	.545	.542	.539	.536	.533	.531	.53	.528	.526
8	.529	.527	.525	.524	.523	.52	.519	.517	.516	.515	.515	514	.513
9	.429	.427	.425	.424	.423	.42	.419	.417	.38	.375	.37	365	.36
10	.298	.295	.293	.29	.289	.288	.286	.285	.278	.276	.275	.274	.273
11	.248	.245	.243	.24	.239	.238	.236	.235	.228	.226	225	.224	223
12	.279	.277	.275	.274	.273	.271	.27	.269	.266	.265	264	.264	.263
13	.229	.227	.225	.224	.223	.221	.22	.219	.216	.215	.214	.214	.213
14	.20	.20	.20	.20	.20	20	.20	20	.20	20	.20	.20	.20

RADIATION LOAD

Key	Factor of Safety over Radiation Load	11000	11200	11400	11600	11800	12000	12200	12400	12600	12800	13000	13200	13400	13600	13800	14000	and Over
1		983	98	978	975	973	971	97	968	965	963	962	958	956	955	953	95	95
2		933	93	928	925	923	921	92	918	915	913	912	908	906	905	903	90	90
3		833	88	878	875	873	871	87	868	865	863	862	858	856	855	853	85	85
4		.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	.92	92	.92	92	.92	.92
5		.633	.63	.628	.625	.623	.621	.62	.618	.615	.613	.612	.608	.606	.605	603	.60	.60
6		.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68
7		.525	.523	.522	.52	.518	.516	.515	.513	.512	.51	.508	.507	.506	.505	.503	.50	.50
8		.512	.512	.511	.51	.509	.508	.507	.506	.505	.505	.504	.503	.503	.502	.501	.50	.50
9		.355	.35	.345	.30	.30	.29	.264	.261	.26	.259	.258	.256	.255	.253	.251	.25	.25
10		.27	.269	.268	.267	.266	.265	.264	.261	.26	.259	.258	.256	.255	.253	.251	.25	.25
11		.22	.219	.218	.217	.216	.215	.214	.211	.21	.209	.208	.206	.205	.203	.201	.20	.20
12		.262	.261	.26	.26	.259	.258	.257	.256	.256	.255	.255	.254	.253	.252	.251	.25	.25
13		.212	.211	.21	.21	.209	.208	.207	.206	.206	.205	.205	204	.203	.202	.201	.20	.20
14		.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	20	.20	.20	.20

NOTE—No boiler to be installed having grate longer than 72".

KEY FOR COMPUTING BOILER SIZES FOR DIRECT RADIATION
As compiled by The Chicago Master Steamfitters Association.

For computing minimum sizes of boilers for the average building based on approved ratings specified in the manufacturers' catalogue.

First reduce all radiation to the equivalent of cast iron column radiation, then use **KEY** applying to boilers and add factor of safety when buildings are heated from 10° to 70° F.

No.	Key
1	Weil-McLain Co., Round Boiler.
2	Hart & Crouse Co., Royal Junior Boiler.
2	Richmond Radiator Co., Round Boiler.
2	United States Radiator Corp., Capitol Winchester Boiler.
3	American Radiator Co., Arco Boiler.
3	Niagara Radiator & Boiler Co.
3	Kellogg Mackay Co., Pebco Boiler.
4	American Radiator Co., Type "C."
°5	Round Cast Iron Up-draft.
°5	Square Cast Iron Up-draft.
6	American Radiator Co., Type "A."
7	American Radiator Co., Type "T" with Arch.
7	Abram Cox Stove Co., Novelty Smokeless.
7	Ideal Furnace Co., Radiant Smokeless.
7	Kellogg Mackay Co., American Smokeless.
7	United States Radiator Corp., Capitol Smokeless.
7	Utica Heater Co., Imperial Smokeless.
7	Cast Iron Double-grate Smokeless
8	Cast Iron Magazine Type.
9	Pacific Portable.
10	Oil City Portable.
10	Herbert Portable and Brick Set Down-Draft
11	Kewanee Smokeless.
12	Herbert Up-draft.
13	Kewanee Up-draft.
14	Kewanee Up-draft with Arch Approved by Standardization Committee.

°Note—All boilers whose ratings have not been changed since May 20th, 1922.

CHICAGO'S FAMOUS WRIGLEY BUILDING

The Famous Wrigley Bldg
Graham, Anderson, Probst & White, Architects

Chicago's famous Wrigley Building, as well as many other well known edifices in this city, is ventilated with Sirocco equipment.

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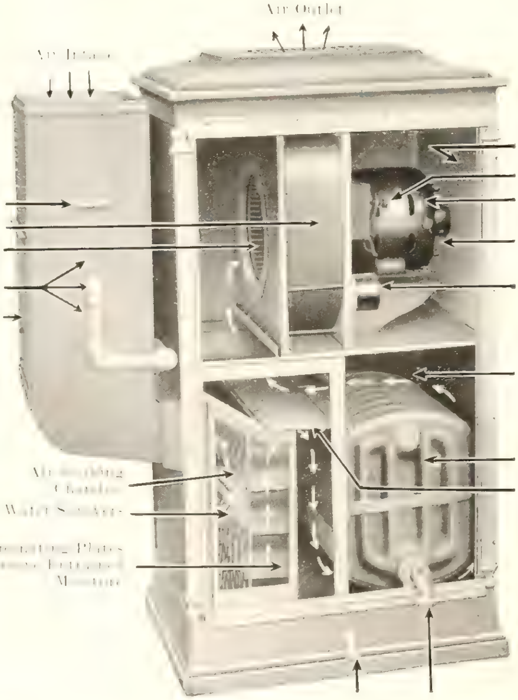
American Blower Co.
DETROIT, MICH.
Chicago Office: Marquette Bldg.



General Air Washing Ventilating Units

For office, store or factory. Will keep the rooms filled with clean, fresh air, cooled or heated to just the right temperature.

Does away with all fans—renders open windows and doors unnecessary, thus eliminating drafts. It is noiseless, inexpensive and simple to operate.

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Wentworth 2456

Contractors for Complete Ventilating Systems. Units manufactured in any capacity. Our Engineers will consult with you regarding your requirements.

SECTIONS OF THE SANITARY CODE OF INTEREST TO ARCHITECTS, WITH INDEX

INDEX

Architect—plans.] Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: That it shall be the duty of any architect or architects, builder or builders of, or other person or persons interested in any projected tenement, lodging house, or other places of habitation, in any incorporated city of fifty thousand inhabitants, to submit plans and specifications of any such building or buildings to the health commissioner or commissioners of such incorporated city; that the said health commissioner or commissioners may examine the said plans and specifications, for his or their approval or rejection, as to the proposed plans for the ventilation of rooms, light and air shafts, windows, ventilation of water closets, drainage and plumbing.

Architect—penalty.] Section 4. If any architect or architects, builder or builders, violate the provisions of this act, he or they shall be fined in a sum not less than one hundred nor more than two hundred dollars for each offense.

BAKERIES.

140. Bakery defined.] Any place used for any process of mixing, compounding or baking, for sale or for purposes of a restaurant, bakery or hotel, any bread, biscuits, pretzels, crackers, buns, rolls, macaroni, cake, pies or any food product of which flour or meal is a principal ingredient, shall be deemed a bakery for the purpose of this chapter; provided, that licensed restaurants in which any of the foregoing food products are mixed and baked for consumption in such restaurant only, on or in ordinary restaurant kitchen stoves or ranges, and kitchens or rooms in dwellings where any of the said food products are mixed and baked in an ordinary kitchen stove or range, shall not be considered bakeries.

145. Sanitary requirements—ventilation.] Every place used as a bakery shall be kept in a clean and sanitary condition as to its floors, side walls, ceilings, woodwork, fixtures, furniture, tools, machinery and utensils. All parts of the bakery shall be adequately lighted at all times and shall be ventilated by means of windows or skylights or air shafts or air ducts or mechanical ap-

paratus, if necessary, so as to insure a free circulation of fresh air at all times. Such ventilating construction and equipment shall be of such character that a complete change of air in all parts of the bakery may be made at least four times each hour; provided, however, that it shall not be necessary to ventilate at such time or in such manner that the process of mixing or rising of dough shall of necessity be interfered with or prevented.

146. Floor—how constructed.] The floor of every place used as a bakery, if below the street level, shall be constructed of concrete, cement, asphalt or other impervious material, or of tile laid in cement, which floor may, if desired, be covered with a hardwood floor having tight joints; if above the street level, the floor may be of hardwood with tight joints or may be of any impervious material, as above provided. The angles where the floor and wall join shall be made and maintained so as to be rat-proof.

148. Walls and ceilings—woodwork.] The side walls and ceilings shall be well and smoothly plastered, tiled or sheathed with metal or wood sheathing, and shall be kept in good repair. If made of mill construction with smooth surfaces, such walls and ceilings need not be sheathed or plastered. All walls and ceilings shall be kept well painted with oil paint, or lime washed and calcimined, and all woodwork shall be kept well painted with oil paint.

156. New bakeries—requirements.] No new bakery shall be hereafter established in any room, basement or cellar in which the clear height between the finished floor and ceiling is less than eight feet six inches or in any room or place, the floor of which is more than five feet below the street, sidewalk or alley level adjacent to the building, or in any room or place which is not so naturally lighted by means of windows, doors or skylights that on clear days a book or paper printed with double long primer type can be read between the hours of ten o'clock a. m. and two o'clock p. m. in all parts of the bakery which are used in mixing or handling bakery products.

261. Walls—divisions and partitions—fire stops.] (a) In buildings hereafter erected used wholly or in part for the purposes of Class IIb of ordinary slow-burning or mill construction, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material separating such eight rooms from the contiguous spaces.

(b) In all buildings hereafter erected to be used wholly or in part for the purposes of Class IIb, all elevators and stairs shall be enclosed in partitions of incombustible or fireproof material, and the partitions oi all corridors leading to such elevators and stairs shall be of fireproof or incombustible material. Such partitions shall be carried on self-supporting masonry or a framework of steel or iron. Where glass is used in said partitions, the same shall be wired glass set in metal frames, but such glass shall not exceed sixty per centum of the superficial area of said partitions.

(c) In all non-fireproof buildings of Class IIb there shall be between joists a stop of brick, concrete or tile not less than four inches in thickness, extending the full height of joists and spaced not more than twenty-five feet apart, measured in the direction of the length of the joist.

262. Sleeping stalls in rooms—when allowed.] Sleeping stalls shall not be constructed or used in any room in any building now existing or hereafter erected and devoted, in whole or in part, to the purposes of a lodging or rooming house unless such room has two or more windows which open directly upon a street, alley, yard or court and which windows have a total area equal to at least one-tenth of the floor area of such room, nor unless the semi-partitions forming such stalls are so constructed that there is a clear and unobstructed interval of at least thirty inches between the top of such semi-partitions and the ceiling of the room, nor unless each such stall shall open directly into an aisle or passageway leading directly to a stairway or stairway fire escape, the location of which is indicated by a red sign and at night by a red light also. Such sleeping stalls shal not be installed in any such room in such numbers that there shall be less than 400 cubic feet of air per person when all stalls are occupied to their full capacity. The semi-partitions forming such stalls hereafter constructed shall be of incombustible material.

274. Habitable rooms — definition of—requirements as to size and ventilation.] (a) For the purposes of this chapter the term "habitable room" shall be held to include every room in every building of Classes III and VI, and every room in buildings of other classes if such rooms are used for the purposes of Classes III and VI, in which a family or the individual members thereof regularly sleep or eat or carry on their usual domestic or social vocations or avocations. Laundries, bath rooms, water closet compartments, serving and storage pantries, storage rooms and closets, boiler and machinery rooms, cellars, corridors, and similar spaces used neither frequently nor during extended periods, shall not be deemed as coming within the scope of this term.

(b) In every building hereafter erected for or converted to the purposes of Class III, every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area, opening onto a street, alley, or yard, as defined in section 432 of this chapter. None of such required windows shall have a glass area of less than ten square feet; and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width. No such habitable room shall have a floor area of less than eighty square feet, nor a clear height from floor to ceiling of less than eight feet and six inches; provided, that attic rooms need not be eight feet six inches high for more than one-half of their area, and that such attic rooms shall have total cubic contents of not less than seven hundred and fifty cubic feet each.

(c) No living room shall be partitioned off or constructed in any existing building or portion thereof, until plans of such building and room have been filed with, and a permit for such partitioning or constructing obtained from the commissioner of buildings and the commissioner of health; and every room so partitioned off or constructed shall comply with all the requirements for habitable rooms as contained in this section.

276. Pantries, bath rooms, water closet and urinal compartments — requirements in relation thereto.] In every building hereafter erected for or converted to the purposes of Class III, every pantry, bath room, water closet or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of at least one foot opening upon a street, alley, or yard as defined in section 432 of this chapter, or upon a vent shaft not less in area than said window; and no habitable room shall open into or connect with a vent shaft thus used.

***432. Definition of "new tenement house" —"apartment"—"yard"—"court" — "shaft"—**

"public hall"—"stair hall" — "basement" — "cellar" — "story" — "solid masonry."] (a) "New tenement house" shall include every tenement, flat and apartment house hereafter erected and every tenement house which shall be increased or diminished in size or otherwise altered after its erection and every building now or hereafter in existence not now used as a tenement house but hereafter converted or altered to such use.

(b) "Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

(c) "Yard" is an open unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

(d) "Court" is an open, unoccupied, unobstructed space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court"; a court bounded on one side and both ends by a tenement house, and on the remaining side by a lot line is a "lot line court"; a court extending to a street, alley or yard is an "outer court."

(e) "Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bathroom, or pantry.

(f) "Public Hall" is a hall, corridor or passageway not within an apartment.

(g) "Stair Hall" includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

(h) "Basement" is a story partly, but not more than one-half below the level of the inside sidewalk grade of the street nearest the building. If the floor of such basement is less than two feet (2 ft.) below such grade or if the ceiling of such basement is more than seven feet six inches (7 ft. 6 in.) above said grade, said story shall be classed as the first story of the building in which it occurs. Provided, however, that the ceiling height may be raised above the height of seven feet six inches (7 ft. 6 in.) heretofore given, not more than one-third of an inch for every foot of such distance said building is set back from the street line of the street nearest the building, but in no case shall any rise of ceiling be allowed for any distance beyond thirty feet (30 ft.) said building may be set back from the line of the street nearest the building, and in such cases all rises in the basement ceiling shall be computed according to the distance between the street line and the outside wall of the building nearest to said steet line. And further provided, that the yard or ground level, or walks, or other improvements thereon for a distance of twelve feet (12 ft.) at every point from all outside walls walls of said building shall not be lower than eight feet three inches (8 ft. 3 in.) below the floor level of the first story of said building.

(i) "Cellar" is a story more than one-half below the level of the inside sidewalk grade of the street nearest the building. Where the grade of a street adjacent to a tenement house varies, the average grade of such street opposite the lot containing the tenement-house shall be regarded as the grade of such street within the meaning of this chapter.

(j) "Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

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* As amended July 2, 1914, and February 8, 1915.

435. New tenement house—when to be occupied.] (a) No new tenement house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the commissioner of health that such building conforms to the requirements of this chapter relative to light and ventilation, plumbing and drainage applicable to said buildings, nor until the issuance by the commissioner of buildings of a certificate that the said building conforms to the requirements of this chapter relative to fire escapes and means of egress applicable to new tenement houses. Within five days from date of application for any certificate above mentioned, such certificate shall be issued or the official concerned shall state in writing his reasons for his refusal to issue said certificate.

(b) The certificate above referred to may be issued in the case of a new tenement building comprising more than three apartments so as to allow the occupation of any section of the building extending from cellar to roof in advance of the completion of the other portions of the building.

(c) When the outer walls of a new tenement house have been erected so as to outline the position of the courts and shafts required for the lighting and ventilation of habitable rooms, the owner of the building or his representative shall be entitled, upon application in writing, to an inspection of the same by the commissioner of buildings, and if the work to that point is in compliance with the provisions regarding the size of the shafts and the location of the building, to a certificate setting forth those facts.

(d) When the work of constructing partitions has advanced to a degree on any floor, that the rooms on that floor are determined in their dimensions, the owner or his representative shall be entitled to an inspection from the commissioner of buildings, and if the rooms thus outlined conform in their dimensions to the plans filed and to the requirements of this chapter, to a certificate stating that fact.

(e) If a new tenement house is occupied as a place of habitation in any of its parts in violation of this section, it shall forthwith be subject to notice from the commissioner of buildings and shall be vacated upon such notice and shall not again be occupied until made to conform with the provisions of this chapter nor until after the issuance of the two certificates required in this section.

447. Air—quantity of for each person.] No room in any tenement house shall be occupied so that the allowance of air to each adult person living or sleeping in such room shall at any time be less than four hundred cubic feet or less than two hundred cubic feet for each person under twelve years of age.

448. Habitable rooms — bathrooms — pantries — requirements as to ventilation and lighting.] (a) In every new tenement house every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area opening onto a street, alley, yard or court. None of such required windows shall have a glass area of less than ten square feet, and each such window shall have its top not less than seven feet above the floor, and shall be so constructed that at least its upper half may be opened its full width.

(b) In every new tenement house every bathroom, water closet, or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of one foot, opening upon a street, alley, yard, court or vent shaft.

(c) In every new tenement house every pantry shall have at least one window of not less than six square feet in area, with a width of not less than one foot, opening into a street, alley, yard, court or vent shaft, which vent shaft shall be at least six square feet in area.

*449. **New tenements—habitable rooms in basements—prohibited in cellars.]** In no new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a new tenement house shall be constructed, altered, converted or occupied for living purposes unless such room shall be at least eight feet six inches high in the clear and shall have at least one-half of such height above the finished grade of said premises at the building, and at least four feet three inches of such height above the average street grade at the building. Provided that only one living apartment not exceeding six rooms shall be allowed in the basement of any tenement house hereafter to be constructed.

* As amended February 8, 1915.

469. **Access to rooms — otherwise than through bedroom.]** In each apartment in every new tenement house, access to every living room and bedroom, and to at least one water closet compartment, shall be had without passing through any bedroom.

471. **Sinks—requirements.]** In every new tenement house there shall be in each apartment at least one kitchen sink with running water. In every existing tenement if there be not one such sink in each apartment there shall be on every floor at least one kitchen sink with running water, accessible to all the tenants of the floor, without passing through any other apartment. In no tenement house shall there be woodwork inclosing sinks; the space underneath shall be left entirely open.

472. **Pipes through floors—catch basins—water closets.]** (a) In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

(b) In the premises of a tenement house the catchbasin shall, whenever practicable, be placed in a court or yard, and shall be covered with a stone or iron cover, flush with the surface so that access to such basin shall be convenient.

(c) Where it is for any reason impracticable to place a catchbasin in a court or yard, the commissioner of health may authorize the use of an iron catchbasin with air-tight cover, located in the cellar or basement.

*475. **Rooms — change in existing.]** No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a window having a superficial area not less than one-twelfth of the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet and a minimum width of not less than two feet six inches, or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, between which two adjoining rooms there shall be an alcove opening equal in extent to at least 20 per cent of the entire wall surface of said room; provided, however, that all of the requirements of sections 439 and 440 of The Chicago Code of 1911 shall be complied with.

* As amended July 8, 1912.

Where a frame tenement house is moved from one lot to another, or from one location to another on the same lot, it shall comply with the provisions of section 452 of this chapter.

476. **Windows—courts—attic.]** No room in any now existing tenement house, which has no such window as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least seven feet six inches distant from every part of the finished floor thereof; provided, that an attic room need be seven feet six inches high in but one-half of its area, and provided, further, that such attic room has not less than seven hundred fifty cubic feet of air space therein; and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

*477. **Existing tenements—living rooms in cellars or basements—when permitted.]** In every existing tenement house, no room in an existing cellar or basement shall be occupied for living purposes unless such room shall be at least seven feet six inches high in the clear, and have not more than four feet eight inches of such cellar or basement below the finished grade at building; provided, that no such room shall be used for living purposes unless such room shall have a window opening upon a street, alley, yard or court, and, provided, that when the windows of any living room front solely upon a street and the floor of such basement is four feet eight inches below the sidewalk grade, such windows shall be located not less than three feet back of the lot line; provided, however, that in every case where the height of ceiling of any living room is less than eight feet six inches in the clear, the window area of such room shall be at least fifteen per centum of the floor area.

(b) When a brick or frame tenement house is moved from one lot to another, or from one location to another on the same lot, and a basement or story, or both, is constructed under the same, the total height of which is more than six feet six inches from the floor to the ceiling, the walls of such basement shall be constructed of masonry according to the provisions of section 658 of The Chicago Code of 1911, and the habitable rooms therein shall comply with the provisions of section 475 of The Chicago Code of 1911, and the space on the lot shall comply with the provisions of section 430 and section 440 of The Chicago Code of 1911.

* As amended July 8, 1912.

477½. **Insanitary condition—nuisance.]** A tenement house or part thereof which is in an insanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water or by reason of the presence of sewer gas, or by reason of any portion of such building being infected with disease, or being unfit for human habitation, or which by reason of any other insanitary condition is a source of producing sickness among the inhabitants of this city, or which in any way endangers the public health, is hereby declared to constitute a public nuisance.

507. **Stories—height of.]** No story above the basement shall be less than twelve feet in height in the clear.

HOSPITALS.

1213. Hospital defined.] For the purpose of this article a hospital is hereby defined to mean any institution or place used for the reception or care, temporary or continuous, of two or more sick, injured or dependent persons; or used for the treatment of two or more persons suffering from or afflicted with any mental or physical disease or bodily injury, including all hydropathic and massage institutions.

For the purposes of this article a maternity hospital is hereby defined to mean any institution or place used for the reception and care, temporary or continuous, of one or more women during pregnancy while awaiting confinement, during confinement, or for one month or less after confinement while recovering therefrom.

Unless otherwise specified, the word "hospital" as used in this article shall be held to include maternity hospital.

1219. Frontage consents required—when.] It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage in any block, in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted exclusively to residence purposes, any hospital, unless the owners of a majority of the frontage in such block, and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces, consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in such block. Such written consents of the majority of said property owners shall be filed with the commissioner of health before a permit shall be granted for the building or constructing or a license be issued for the maintaining, conducting or managing of any such hospital.

1220. Location of hospitals near school.] No hospital of any kind or description shall hereafter be erected or established within four hundred feet of any property used for public or parochial school purposes.

1330 Method of slaughtering—offensive odors to be destroyed—construction of condensers.] The keeping and slaughtering of live stock and the preparation and keeping of all meat, fish, birds and fowls, and the rendering of all animal matter and the manufacture of glue and all by-products from animal matter shall be conducted in that manner which is, or is generally reputed or known to be, the best adapted to secure and continue their safety and wholesomeness as food, and to avoid all offensiveness of such keeping, slaughtering, rendering and manufacturing. Blood from slaughtered animals shall not be allowed to flow into any sewer or into the Chicago river or any of its branches, but while still fresh shall be treated so as not to become offensive.

All offensive odors arising from the handling of meat or other animal matter, melting or rendering, and the treating of and caring for offal, blood or any other material stored or manufactured, shall be destroyed by combustion, condensation or other means equally effective, and according to the best and most approved means and processes, and shall not be allowed to escape into the outside air. In the event that condensation shall be adopted as a method of destroying offensive odors or gases, the method of condensation employed shall be as follows:

Every rendering establishment shall use as condensers, tanks or other suitable airtight condensing appliances, with an overflow connecting with a sewer, and shall have a feed water pipe of sufficient diameter by which a continuous stream of cold water shall pass into the condenser and escape through the aforesaid overflow at or near the top, and all gases generated in the process of boiling shall be carried to and entered into the bottom of and under the body of water contained by said condenser, and such gases as are not condensed in the water shall be carried through another pipe connected with the top of the condenser, to the boilers or other places where heat of not less than six hundred degrees Fahrenheit is maintained, and shall there pass through such fire and be consumed. While the condenser is in use it shall be obligatory on the part of the user to allow sufficient water to flow through the condenser to maintain a temperature not higher than one hundred degrees Fahrenheit.

A condenser of the spray, jet or other suitable pattern shall be connected with all dryers operated, and a fan or pump shall draw the vapors from the dryer and force them through such condenser, the water from which shall pass into the sewer, and a sufficient quantity of water shall be used to thoroughly condense any and all vapors and odors conveyed thereto.

To the end that a proper inspection may be readily made by the authorities of the temperature maintained in such condensers, there shall be attached to each of such condensers an automatic or self-registering thermometer of such a character as will automatically keep a daily record of the temperature maintained in each such condenser at all times during the use thereof.

UNDERTAKERS; CARE OF DEAD HUMAN BODIES; BURIALS.

1238. Frontage consents.] It shall be unlawful for any person to carry on the business of an undertaker, as defined in this article, who, in connection with such business, receives at his place of business the body of any dead person, for embalming or other purposes, where such place of business is located on any street in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, without the written consent of a majority of the property owners according to the frontage on both sides of such street in such block; provided, however, that nothing herein contained shall apply to persons licensed as undertakers at the time of the passage of this ordinance.

Such frontage consents shall be obtained and filed with the department of health before a license shall issue for such business.

1239. Undertaking rooms.] No person shall be licensed to carry on the business of undertaking in any establishment, store or place, unless such establishment, store or place shall be provided with a compartment or room completely shut off or capable of being completely shut off from the other

parts of such establishment, store or place; such compartment or room shall have free outside ventilation and light, and its floor shall be constructed of or covered with a non-absorbent material and shall be connected with a sewer by an approved sanitary drain.

TENEMENTS AND LODGING HOUSES.

1376. Conform to requirements.] No house or building hereafter erected shall be used as a tenement house or lodging house, and no house or building heretofore erected and not now used for such purposes shall be converted into, used or leased for a tenement or lodging house, unless in addition to the requirements hereinbefore contained in article IX of chapter XVI of this ordinance, it conforms to requirements affecting tenement or lodging houses, or both, as specified in the following sections of this article.

1377. Distances between buildings on same lot.] It shall not be lawful hereafter to erect for or convert to the purpose of a lodging house a building on any lot, other than a corner lot, where there is another building on the same lot, unless there is a clear, open space exclusively belonging thereto, and extending upwards from the ground, of at least ten feet between such buildings, if they are one story high above the level of the ground; if they are two stories high, the distance between them shall not be less than fifteen feet; if they are three stories high, the distance between them shall not be less than twenty feet; and if they are more than three stories high, the distance between them shall be not less than twenty-five feet.

1378. Lodging house—ventilation.] Every house, building or portion thereof in the city, designed to be used, occupied, leased or rented, or which is used, occupied, leased or rented, for a lodging house, shall have in every room which is occupied as a sleeping room and which does not communicate directly with the external air, a ventilating or transom window having an opening or area of three square feet over the door leading into and connected with the adjoining room, if such adjoining room communicates with the external air, and also a ventilating or transom window of the same opening or area communicating with the entry or hall of the house; or where this is from the relative situation of the rooms impracticable, such last mentioned ventilating or transom window shall communicate with an adjoining room that itself communicates with the entry or hall. Every such house or building shall have in the roof at the top of the hall an adequate and proper ventilator. No room in any lodging house shall be so occupied that the allowance of air to each person living or sleeping in such room shall at any time be less than four hundred cubic feet for each such person more than twelve years old and two hundred cubic feet for each such person of the age of twelve years or under.

1379. Height of ceilings—windows.] In every such house hereafter erected or converted, every habitable room except rooms in the attic sha'l be in every part not less than eight feet ın height from the floor to the ceiling; and every habitable room in the attic of any such building shall be at least eight feet in height from the floor to the ceiling throughout not less than one-half the area of such room. Every room shall have at least one window connecting with the external air, or over the door an adequate ventilator connecting it with a room or hall which has a connection with the external air, and so arranged as to produce a cross current of air. The total area of window or windows in every room communicating with the external air shall be at least one-tenth of the superficial area of every such room; anl the top of one at least of such windows shall not be less than seven feet and six inches above the floor, and the upper half at least shall be made so as to open the full width. Every habitable room of a less area than one hundred superficial feet, if it does not communicate directly with the external air, and is without an open fireplace, shall be provided with a special means of ventilation by a separate air shaft extending to the roof, or otherwise, as the commissioner of health may prescribe.

1380. Water supply—cellar floor—ventilation of halls.] Every such house hereafter erected or converted shall have proper conveniences and receptacles for ashes and rubbish; it shall have water furnished at one or more places in such house or in the yard thereof, so that the same may be adequate and reasonably convenient for the use of the occupants thereof; it shall have the floor of the cellar properly cemented so as to be water-tight; the halls of each floor shall open directly to the external air, with suitable windows, and shall have no room or other obstruction at the end, unless sufficient light or ventilation is otherwise provided for said hall in a manner approved by the commissioner of buildings.

1388. Lodging house defined.] A lodging house shall be taken to mean and include any house or building or portion thereof in which persons are harbored or received or lodged for hire for a single night or for less than a week at one time, or any part of which is let for any person to sleep in for any term less than a week.

1389. Penalty.] Any person who shall violate, disobey, neglect or refuse to comply with, or resist, any of the provisions of this article, or who refuses to comply with any of the sanitary regulations of the department of health concerning any of the matters or things mentioned in this article shall be fined not less than ten dollars nor more than two hundred dollars for each offense.

WORKSHOPS.

1390. Workshop defined.] Any place where goods or products are manufactured or repaired, cleaned or assorted, in whole or in part, for sale or for wages, shall be taken and be held to be a workshop; and whenever any house, room or place is used for the purpose of carrying on any process of making, altering, repairing or finishing, for sale or for wages, any coats, vests, trousers, knee pants, overalls, cloaks, shirts, ladies' waists, purses, feathers, artificial flowers, or cigars, or any wearing apparel of any kind whatsoever intended for sale, it shall be deemed a workshop for the purposes of this article.

No one of the articles mentioned in this section shall be made, finished, altered or repaired in any room or apartment used as a living room or a sleeping room; nor shall any workshop be conducted, maintained, op-

erated or carried on in any cellar or basement.

STORES, FACTORIES, WORKSHOPS—MISCELLANEOUS PROVISIONS.

1399. Ventilation of stores, factories, workshops, etc.] No person, being the owner, proprietor, lessee, manager or superintendent of any store, factory, workshop or other structure or place of employment where workmen and workwomen are employed for wages, shall cause, permit or allow the same or any portion or apartment of, or any room in such store, factory, workshop or other structure or place of employment, to be overcrowded or inadequate, faulty or insufficient in respect of light, ventilation, heat and cleanliness; and in every such building or apartment, or room in any such building, where one or more persons are employed as aforesaid, at least five hundred cubic feet of air space shall be allowed to each and every person employed therein, and fresh air supplied by ventilation at the rate of four complete changes of air per hour during the hours of employment. No part of such air supply shall be taken from any cellar or basement.

1402. Seats for females.] It shall be the duty of all employers of females in any mercantile or manufacturing business or occupation to provide and maintain seats for the use of such female employes, and to permit, to a reasonable extent, the use of such seats by such employes during the hours of their employment, for the preservation of their health. Seats shall be furnished at the ratio of one seat for every four female employes. All mercantile and manufacturing occupations and establishments where females are employed shall be inspected by officers of the health department to ascertain if this section is complied with, and any employer violating any of the provisions of this section shall be subject to a fine of not less than five dollars nor more than one hundred dollars.

1403. Penalty.] Any person violating, disobeying, neglecting or refusing to comply with any of the provisions of this article, where no other penalty has been provided, shall be fined not less than ten nor more than one hundred dollars for each offense.

DRY CLEANERS.

2854. Building requirements—ventilation — equipment — lighting — water trough.] Every building used or intended to be used for the purpose of conducting or carrying on the business of dry cleaning, as defined in this chapter, shall be constructed and equipped according to the following specifications:

Every such building shall be built of brick, stone or concrete, with no basement, and shall not exceed two stories in height; provided, however, that the use of any building not exceeding three stories in height in which a dry cleaning business was carried on prior to the passage of this ordinance may be continued, if such building complies in all other respects with the provisions of this chapter. The first floor of such building shall be higher than the surface of the ground surrounding such building and shall be so laid that there shall be no space underneath the same. The floor or floors and roof shall be of fireproof construction, and such floor or floors shall be covered with a wire carpet. There shall be no openings through the floors, excepting in two-story buildings in which a stairway leading from the second floor to the first floor may be permitted, if properly enclosed with walls of incombustible material. Such stairways shall lead to the outside of the building without any doors or openings leading into the dry cleaning room. Every such building shall be detached from all other buildings, or separated from all other buildings by a fire wall, with no openings to the adjoining building thereto, and shall not be occupied for any purpose other than the conduct of a dry-cleaning and dry-room plant. The walls of such building shall be not less than twelve inches thick and shall have vent holes at the floor line, not less than sixteen square inches in area, not less than six feet apart, measured from center to center, which vent holes shall be protected by screens of thirty mesh brass wire on the inside of such walls, and by iron bars or by screens of large mesh on the outside of such walls.

Such building shall be further ventilated by means of an exhaust fan or fans of sufficient capacity to change the air in the building every three minutes, and shall be kept in operation at all times during the use of such building. Such exhaust fan shall be located in an air conduit whose inlet openings shall be at or near the floor level in the wall farthest away from any other building or structure, and the discharge end of such conduit shall be carried over the roof of such building.

All doors in any such building shall be constructed of incombustible materials and shall open outward. All window openings of such building shall be protected by fire resisting glass with metal sash and frames, or by outside iron shutters.

Every such building, two stories high, shall be provided with two stairways leading from the second to the first floor, at least one of which must be placed on the outside and be constructed of iron or steel.

Every such dry-cleaning plant shall be equipped with a high pressure steam boiler of sufficient capacity to admit of flooding the dry cleaning and drying rooms with steam in case of fire. Each room of such building shall be equipped with a line of one and one-fourth inch pipe connected with a one and one-fourth inch supply line leading from such high-pressure boiler and having down-spouts of at least two inches in length and not less than ten feet apart, distributed over washers and extractors. The valves operating such lines of pipe shall in every case be placed outside of such building; provided, however, that every such dry cleaning plant, constructed and maintained prior to the passage of this ordinance, may, in place of such high-pressure boiler, be equipped with a suitable and adequate tank or tanks containing carbon dioxide. At least one such tank, containing not less than one hundred eighty cubic feet of gas under pressure, shall be provided for each one thousand cubic feet, or fraction thereof, of cubic contents of the room to be protected from fire. The valve or valves operating such tank or tanks shall be located on the outside of such building.

NEW McVICKERS THEATRE, CHICAGO

Whenever steam power shall be used for the operation of any machinery contained in any such dry cleaning establishment, the boiler generating such power shall be located in a separate building and so situated that the line of travel for gases, between the boiler and the nearest opening into the cleaning or drying room, shall be not less than twenty feet, and whenever electrical power is used, the electric motor furnishing such power shall be similarly located; provided, however, that such boiler and electric motor may be located in the same building where such building was used for dry cleaning purposes prior to the passage of this ordinance, if such boiler or electric motor are separated from the dry cleaning or drying room by fire walls having no openings into such dry cleaning or drying room, except such openings as may be required for shafts in operating the machinery contained therein.

Every such building shall be lighted by incandescent electric lamps having keyless sockets, protected by vapor-tight outer globes, and controlled by outside switches. No open light or light or flame of any kind whatsoever shall be allowed or used therein.

Every such establishment shall be provided with a tank not less than four feet long, two feet wide and three feet deep, which shall be placed near the entrance to the dry cleaning room and shall be kept filled with water.

2855. Handling of oils.] Tanks for the storage of any one or more of the oils or fluids mentioned in section 2851 of this chapter must be placed outside of the buildings used for such dry cleaning establishment and must comply with the ordinances of the city of Chicago relating to the storage of oils. No such tank shall be built underneath any such building. Pumps or devices for the removal of the contents of such tanks, which are operated by hand power, and which have been approved by the fire marshal of the city of Chicago, may be placed inside of any such building. All gasoline used in any such building shall be conveyed to and from the same through closed metal piping; no open troughs shall be permitted. There shall be no piping or connection whereby any of the oils or fluids mentioned in this chapter may flow from the cleaning room into any public or private sewer, drain, catch basin or pit.

AMENDMENTS TO THE SANITARY CODE PASSED SINCE MARCH 13, 1911.

An Ordinance, Passed November 20, 1911, Amending Section 2854 of The Chicago Code of 1911.

Be it ordained by the City Council of the City of Chicago:

Section 1. That the first three paragraphs of Section 2854 of The Chicago Code of 1911, being all that part of said Section 2854 before the paragraph beginning, "All doors in any such building," be and the same are hereby amended so as to read as follows:

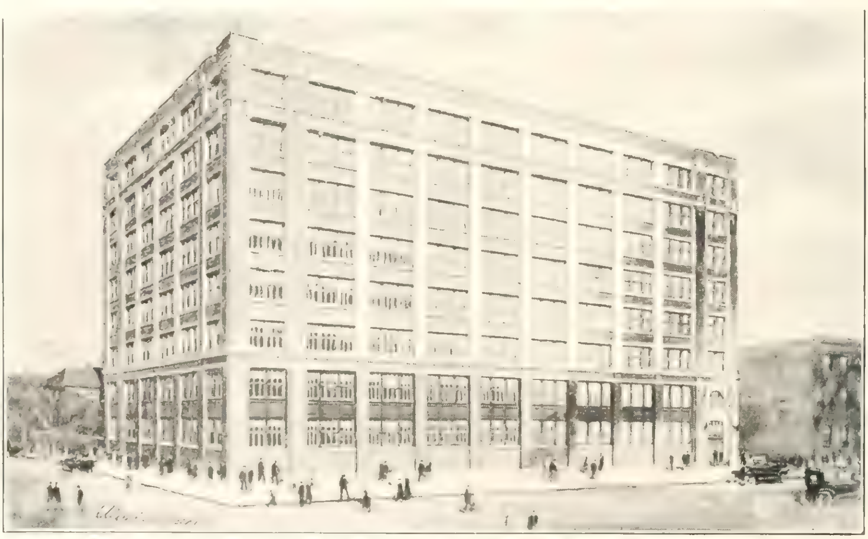
"**2854. Building Requirements — Ventilation—Equipment—Lighting—Water Trough.]** Every building used or intended to be used for the purpose of conducting or carrying on the business of dry cleaning as defined in this chapter, shall be constructed and equipped according to the following specifications:

Every such building shall be built of brick, stone or concrete, with no basement, and shall not exceed two stories in height; provided, however, that the use of any building not exceeding three stories in height, in which a dry cleaning business was carried on prior to the passage of this ordinance may be continued, if such building complies in all other respects with the provisions of this chapter. The first floor of such building shall be higher than the surface of the ground surrounding such building, and shall be so laid that there shall be no space underneath the same. The floor or floors and roof shall be of fireproof construction. There shall be no openings through the floors, excepting in two-story buildings, in which a stairway leading from the second floor to the first floor may be permitted, if properly enclosed with walls of incombustible material. Such stairways shall lead to the outside of the building without any doors or openings leading into the dry cleaning room. Every such building shall be detached from all other buildings; provided, however, that the use of any building in which a dry cleaning business was carried on prior to the passage of this ordinance may be continued where such building is separated from all other buildings by a fire wall, with no openings into any adjoining building. Such building shall not be occupied for any purpose other than the conduct of a dry cleaning and dry room plant. The walls of such building shall be not less than twelve (12) inches thick and shall have vent holes at the floor line not less than sixteen (16) square inches in area when ventilation by means of exhaust fan or fans is employed, and not less than thirty-two (32) square inches in area when ventilation by means of paddle-wheel type fan or fans is employed; such vent holes shall be not less than six (6) feet apart, measured from center to center, and shall be protected by screens of thirty (30) mesh brass wire on the inside of such walls, and by iron bars or screens of large mesh on the outside of such walls.

Such building, unless divided into compartments, as hereinafter described, shall be further ventilated by means of an exhaust fan or fans of sufficient capacity to change the air in the building every three minutes, and shall be kept in operation at all times during the use of such building. Such exhaust fan shall be located in an air conduit whose inlet openings shall be at or near the floor level in the wall farthest away from any other building or structure, and the discharge end of such conduit shall be carried above the roof of such building. If such building be divided into fireproof compartments, by partitions of six-inch hollow tile, or equivalent, extending from floor to ceiling, each such compartment having a capacity of not to exceed twenty-five hundred (2500) cubic feet, the exhaust fan or fans and air conduit before mentioned may be omitted from each of such compartments, and in lieu thereof there shall be a paddle-wheel type fan attached to the line shafting in each compartment, of sufficient size to displace an amount of air equal to the cubical contents of the compartment at least once each minute."

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.

Drake Hotel, Chicago, Ill. Arcade Steam Heating Co., Heating Contractors



Atwell Building 20th St. and Prairie Ave., Chicago, Ill.

Alfred S. Alschuler, Architect. K. P. Beardslee, Mech. Engineer.

FURNACE DESIGN

with Special Reference to Hand Fired Boilers and Limitations of Each Design

by FRANK A. CHAMBERS of the Smoke Prevention Association of America

The development of industrial centers brings with it the problem of abating the nuisance resulting from the emission of smoke from the chimneys of its power and industrial plants, residences, and apartment houses, and from the stacks or locomotives. Smoke, however, has no defense, its formation being primarily due to incomplete combustion or fuel, resulting from and due to defects in the operation, design or installation. Modern engineering practice has demonstrated that it can be abated.

The City of Chicago first recognized the desirability of legislating against smoke in 1881, when an ordinance prohibiting the emission of dense smoke was passed by the City Council. This ordinance was subsequently amended, until the ordinance as it stands today, was adopted. The ordinance uses the words "dense smoke" and for years the city of Chicago has considered this to mean smoke which cannot be seen through at the point of emission from the chimney. This does not mean that the smoke must be black in color or that it must be so dense that no light pierces through, but it must be so dense that an object placed on the side opposite to the observer cannot be clearly defined through the smoke.

CITY SUPERVISION OF FUEL BURNING EQUIPMENT

The ordinance provides that plans be submitted and permits be secured for new fuel burning plants and for the reconstruction and repair of old ones. This provision of the ordinance of 1907 was a new departure in municipal smoke prevention work and in planning this section the idea was that if any permanent and lasting good was to result, the details of the plant equipment must be carefully studied by competent engineers and every precaution taken to so construct that smoke might be prevented.

In determining whether a proposed furnace will smoke, three factors have to be conconsidered.

First: The kind of fuel to be used.

Second: Attention to be paid to proper firing.

Third: Character of equipment for burning fuel.

The character of equipment is of vital importance in the smokeless operation of any boiler plant. Development of the smoke abatement work has shown that a great deal of Chicago's smoke was due to poor equipment and the successful application of supervision by the City, demonstrated by very pronounced reductions in the average density of smoke throughout the entire city, has proven that this third feature is most important and desirable.

If the elimination of smoke is to be brought about the general standard of equipment must be such as will make up for the natural fuel conditions, and allow for such carelessness in operation as is to be expected.

The requirements of the ordinance as regards equipment, for new and reconstructed plants, are very broad; the code merely stating that plans submitted shall indicate all provisions made for the purpose of securing complete combustion of the fuel used and for the purpose of preventing smoke. It is left to the judgment of the smoke inspector to determine if these general requirements have been complied with and the standards existing today are the result of the knowledge gained through experience with the actual operating conditions. The three important items entering into this determination are—

First: Sufficient draft to burn the maximum amount of coal to be consumed.

Second: Sufficient space to properly operate and maintain the equipment.

Third: Properly designed furnace to secure complete combustion; all other requirements complied with.

The chimney height is determined by the amount of draft required at its base and this in turn is calculated from the sum total of draft over fire required, plus the losses encountered in boiler, setting and breeching.

Area of Stacks.

Quantity of gas to be handled and its velocity are the two main factors determining the chimney area. Velocities of from 10 to 40 feet per second are met in common practice. In stacks connected to heating boilers an average velocity of 10 feet per second, and in those connected to high pressure boilers, 25 feet per second, are good working averages. The free area of the stack at the smallest cross section should be not less than 1/5 of the area of the total connected grate surface, where the stack is less than 150 feet high. The rule used in determining stack area for Horizontal Return Tubular and Scotch Marine and Fire Box Boilers, is to provide an area equal to 125 per cent of the boiler tube area. A convenient method employed in calculating stack areas is as follows:

$$\text{Area of stack} = \frac{HP \times 55.08}{\sqrt{H}}$$

H = Height of stack.

Space Requirements.

It has often been said that the power or heating plant is the last thing thought of by the architect in designing buildings, and it is true that in most cases the least space possible is allotted for boiler equipment. As a result of this situation, there is seldom space enough for well designed furnaces, the breechings have unnecessary turns, firing space is limited, ventilation poor, and cleaning facilities faulty. In numerous plants in Chicago today which were erected prior to the time the ordinance required city supervision, lack of space is the stumbling block encountered in proper reconstruction and rehabilitation.

Fuel.

The ordinance requires a statement of the kind of fuel proposed to be used. The framers of the ordinance recognized that in certain classes of equipment it is desirable to use anthracite and semi-bituminous coal and agreements are entered into with the plant owners to permit the installation of boilers and furnaces which are limited to the use of smokeless fuels. These are called fuel agreements, and in general are restricted to the use of power boilers containing not

more than 250 square feet of heating surface and heating boilers rated at not more than 2,600 square feet of steam radiation and 4,100 feet of water radiation. In special cases, where circumstances warrant it, larger sizes are permitted under fuel agreements.

Stacks.

The chimney has often been called the heart of the plant and certainly plays an important part in its successful operation. The requirements regarding height and area are mentioned above but its location and relation to the boiler are very important, and these features are closely watched in examining boiler plans. In general, the requirements are that it be so located as to permit the installation of a well designed breeching with a minimum number of turns or angles. Attention is paid to the location and size of breeching opening in chimney to avoid downward pitches in breeching as it enters the stack, and to provide an opening approximating a square as nearly as possible.

Head Room.

Provide sufficient head room to allow for generous combustion space and to allow for boilers of ample capacity, breechings of good form, accessibility to manholes and valves, provision for meeting with the requirements of the building code in so far as protection against fire is concerned.

Floor Space.

Provide sufficient floor space for operating the furnaces, renewing the boiler tubes, cleaning the soot from the tube region, allowing for easy access to the furnace inspection doors, and that the location of the coal storage does not interfere with the operation of the furnaces.

Adequate Ventilation.

Plans and specifications shall show that the room or apartment in which such plant shall be located is provided with doors, windows, air-shafts, fans and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portion of such building, wherein such steam plant or apparatus is to be used, from rising to a point higher than 120 degrees Fahrenheit, and sufficient also to provide that the atmosphere of any such apartment, wherein such apparatus may be located, may be entirely changed every ten minutes.

Furnace Equipment.

The general policy first adopted by the smoke department was to determine by inspection of existing plants, whether or not they could be operated within the requirements of the ordinance with average care. By process of elimination certain constructions and types of equipment were eliminated and approval refused on those constructions.

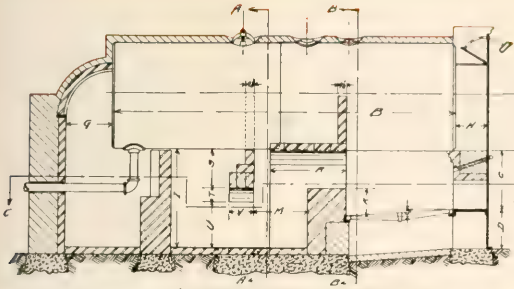
Although this article deals with requirements for hand fired furnaces, certain of these are applicable to all fuel burning equipment. The department requires that mechanical stokers be used where new equipment is being installed in connection with all boiler units exceeding 250 boiler horse power, except as the nature of the fuel or other conditions exclude the use of mechanical stokers. For wood and refuse burning furnaces, hand fired equipment is acceptable. The department advocates and urges the use of automatic stokers wherever conditions make them desirable.

Space and time do not permit a paper covering all types of hand fired furnaces with the numerous types of boilers in use in Chicago today. I will try to deal only with hand fired furnaces in connection with horizontal return tubular and horizontal water tube boiler, the latter being horizontally baffled. This embraces equipment as is used with such boilers as the Heine, Kroeschell, B. & W., EdgeMoor, Lyons, Casey-Hedges, Springfield, Keeler, and Oil City. The first item considered is the setting height. For best results from a smoke elimination standpoint, the heating surface should be set as near the fire as possible and still provide ample room for combustion. The result is better heat absorption and better combustion, with less smoke, due to lower initial furnace temperature with a resulting less violent distillation of the volatile matter in the coal. The space required between grate and heating surface should be such that there is no restriction to the expansion of gases in this region and no interference with the mixture of air and the combustible gases. The gases rise from the fuel bed in a vertical direction until the force of draft bends them toward the rear. They seldom impinge against the heating surface forming the roof of the furnace. The chilling from the adjacent heating surface has no material effect on combustion as there is a strata or film covering the shell that moves at a comparatively less velocity and is usually impeded by the roughness of the furnace roof. The setting heights are based on a requirement of 25 percent opening over the bridge wall and where this is an unrestricted opening, the height of boiler setting is equal to 25 percent of the grate length, plus the height of the bridge wall, less the pitch of grates. Bridge wall heights of not less than 18 inches are recommended and a grate pitch of not more than one inch to one foot of length are approved.

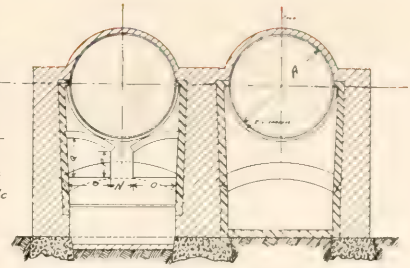
It has been found desirable, after experimenting with different setting heights, to reduce the distances between the grate and shell of the boiler to the standards that are being followed at the present time. This change proved desirable not only on account of smoke elimination but from a fuel-saving standpoint as well.

In the 1911 report of the Smoke Department are illustrated seven types of furnaces known as the Department No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, and No. 7. It is interesting to note that development of smokeless furnace designs has eliminated all but one of these types, (No. 6) from common use. A new design, patented by H. Misostow, has been added to the list of departmental furnaces, and is known as the No. 8. Since its adoption, approximately 85 percent of the hand fired furnaces of the types being considered in this paper, have been of this design or a modification of it. The No. 8 construction consists of an arrangement of fire brick piers built in the combustion chamber.

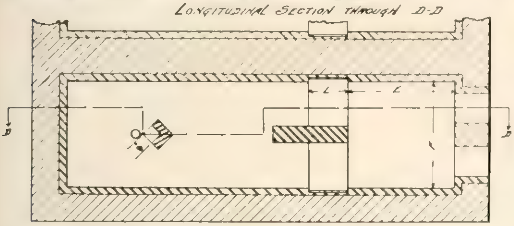
The No. 6 which is popularly known as the Double Arch Bridge Wall Furnace, is an arrangement of brick arches forming retorts over the bridge wall and a deflection arch or diaphragm placed in the rear of the bridge wall. This type of constuction has been in very common use in connection with high pressure boilers, and with reasonable care has been successful in smoke elimination.



LONGITUDINAL SECTION THROUGH D-D



SECTION THROUGH BB SECTION THROUGH AA



PLAN SECTION THROUGH "C-C"

DIMENSION SHEET FOR DEPARTMENT NO 6 FURNACE

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
42	[illegible]	28	19	42	42	22	16	42½	[illegible]	[illegible]	[illegible]	21	9	[illegible]	[illegible]	[illegible]	21	[illegible]	8	9½	[illegible]	8
42	[illegible]	28	19	48	42	22	16	44	4	[illegible]	18	24	[illegible]	[illegible]	[illegible]	[illegible]	21	7	8	9	[illegible]	8
48	[illegible]	30	20	42	48	24	18	45½	3½	8	8	20	9	[illegible]	[illegible]	[illegible]	21	[illegible]	8	22	[illegible]	8
48	[illegible]	30	20	48	48	24	18	45½	4	[illegible]	8	24	9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8	20	[illegible]	8
48	[illegible]	30	20	54	48	24	18	49½	4½	[illegible]	18	26	9	[illegible]	[illegible]	[illegible]	21	[illegible]	8	22	[illegible]	8
54	[illegible]	32	22	48	54	24	18	45½	4	[illegible]	8	24	[illegible]	[illegible]	[illegible]	8	27	[illegible]	9	21	[illegible]	8
54	[illegible]	32	22	54	54	24	18	52	4½	[illegible]	8	24	[illegible]	[illegible]	[illegible]	20	[illegible]	[illegible]	9	21	[illegible]	8
60	[illegible]	34	22	60	60	26	18	55½	5	[illegible]	[illegible]	26	[illegible]	[illegible]	13	[illegible]	36	22	10	[illegible]	[illegible]	8
60	[illegible]	34	22	66	60	26	18	60½	5½	[illegible]	[illegible]	26	[illegible]	[illegible]	[illegible]	[illegible]	36	24	10	[illegible]	[illegible]	8
66	[illegible]	34	24	60	66	28	18	54½	5	[illegible]	[illegible]	28	[illegible]	[illegible]	[illegible]	[illegible]	36	[illegible]	11	23	[illegible]	8
66	[illegible]	34	24	66	66	28	18	59	5½	[illegible]	[illegible]	28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	8
72	[illegible]	36	24	66	72	30	20	59½	5½	[illegible]	[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	36	[illegible]	12	21	[illegible]	8
72	[illegible]	36	24	72	72	30	20	64½	6	[illegible]	[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	20	[illegible]	8
78	[illegible]	38	26	72	78	32	21	65	6	9	26	32	[illegible]	30	[illegible]	[illegible]	[illegible]	26	12	20	[illegible]	8
78	[illegible]	38	26	78	78	32	21	70	6½	[illegible]	26	32	[illegible]	30	[illegible]	[illegible]	[illegible]	27	12	21	[illegible]	8
84	[illegible]	38	26	72	84	32	21	64	6	20	26	36	18	33	[illegible]	27	45	24	12	20	[illegible]	8
84	[illegible]	38	26	78	84	32	21	69	6½	[illegible]	26	36	18	33	16	[illegible]	45	26	12	21	[illegible]	8

NOTE: Dimensions in the above table apply only for the ordinary conditions and are subject to revision for unusual conditions

A modification of this furnace for low pressure work, known as the Department No. 7, is also used to a considerable extent. The change from the No. 6 consists in building a drop arch over the grates at a point above ¼ of the grate length in front of the bridge wall. This permits of firing by the coking method, green coal being fired in large charges in front of the coking or ignition arch, and pushed back when thoroughly coked, before the next charge of coal is fired.

Other types of hand fired furnaces, which are patented and controlled by furnace contractors, are the Twin Fire Furnace, Down Draft Furnace, Foltz Smokeless Furnace, Chicago Tile Arch Furnace and others of special construction. In general, the requirements for these are similar to the department furnaces and the area of gas passages and provision for mixing gases conform to the rules laid down for the others.

Air Admission.

The basis of efficiency in combustion is a correct mixture of air with the combustible. This item, which has an important bearing on smokeless combustion is a matter given special attention by the department. Provision must be made for the admission of air over the fire and although there are a number or arrangements for pre-heating the air supply, and discharging it at various points in the furnace, a common practice is to cut a panel opening in the fire doors having an aggregate of four square inches per square foot of grate surface. These panels are usually fitted with a ratchet arrangement so as to allow the desired amount of air to enter over the fire.

Steam Jets.

Steam jets entering the furnace front above the firing doors and so installed as to syphon air into the firebox, are required on all types of hand fired furnaces where such mechanical mixers are necessary. When properly applied and operated, they assist in reducing the smoke to satisfy the requirements of the ordinance and should be so adjusted that the center line of the steam pipe, if extended, will strike the bridge wall at a point six inches above the intersection of the grate and bridge wall. An automatic steam jet that operates in conjunction with the opening of the fire door is desirable, although not required.

The best combination of this kind is the one that adequately delivers the necessary air with the least possible amount of steam and so adjusted as to at least open automatically (for instance in conjunction with the fire door) and patented devices **offer no** advantage over that which any competent engineer is capable of installing.

By reason of the low cost of steam jets, they are very widely used to regulate smoke, but not without objection thereto. The steam jets are to be so directed that the center line projected immediately over the highest part of the fire will strike the bridge wall as near the rear end of the grate as is possible.

The so-called "smoke devices" of which there are a large number appearing on the market, and which must be held distinctly apart from construction of recognized merit, are not unqualifiedly approved by the department unless as much provision for smoke prevention is made as is incorporated in those furnaces above mentioned. These devices usually consist of special means for the admission of air and steam above the fire to create a condition where complete combustion may be obtained. The policy of the department has been that these devices do not in themselves meet the department requirements, although in conjunction with well designed furnaces they aid very materially, and their use is recommended.

The popular conception of a smoke consumer is a device that can be attached to a boiler or furnace and with its adoption will eliminate smoke. However, as all well informed engineers know, there is no device or apparatus or construction that is a cure-all for all smoke troubles, and their indiscriminate use is a serious mistake and leads to trouble. The **best** furnace is the one that meets the conditions to be encountered in any given case and supplies all the requisites for the proper functioning of this particular installation.

MINIMUM HEAD ROOM REQUIREMENTS FOR SMOKELESS SETTINGS.

		Horizontal Return Tubular				Water Tube				
	Furnaces	54"	60"	66"	72"	Hor. Baff 1"-1½" Pitch	Vert Baff 1"-1½" Pitch	Hor Baff 3¼" Pitch	Vert Baff 3¼" Pitch	Scotch Marine
		Shell to Dead Plate	Shell to Dead Plate	Shell to Dead Plate	Shell to Dead Plate	Front Header to Floor				
Hand Fired	No. 6	32"	34"	34"	36"	**6'0"	*	**6'6"	*	##
Hand Fired	No 7 (Modified)	32"	34"	34"	36"	=				##
Hand Fired	No 8	32"	34"	34"	36"	6'0"	*	6'6"	*	##
Hand Fired	Hand Stoker	26"	28"	28"	30"	5'6"	*	6'0"	*	Full Extension
		Shell to Floor	Shell to Floor	Shell to Floor	Shell to Floor					
Hand Fired	Down Draft	60"	60"	60"	60"	6'0"	*	6'6"	*	Full Extension
Hand Fired	Twin Fire	58"	60"	62"	64"	6'0"	*	6'6"	*	*
Hand Fired	Semi Ext Refuse Burning	44"	46"	46"	48"	7'0"	*	7'6"	*	*
Gravity Feed	Burke	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
Gravity Feed	McMillan	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
Gravity Feed	Twin Fire (Gravity)	48"	48"	50"	54"	5'0"	*	5'6"	*	Full Extension
	Chain Grates	72"	72"	78"	78"	7'0"	9'0"	8'0"	10'0"	##
Front Feed	Moore	48"	54"	60"	60"	6'0"	8'6"	6'6"	9'0"	##
Front Feed	Roney	60"	60"	60"	72"	7'0"	9'0"	7'6"	10'0"	##
Front Feed	Wetzel	60"	60"	60"	72"	7'0"	9'0"	7'6"	10'0"	##
Side Feed	Detroit	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension
Side Feed	Model	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension
Side Feed	McKenzie	66"	70"	70"	70"	7'6"	*	8'0"	*	Full Extension
Side Feed	Murphy	66"	72"	78"	84"	7'6"	*	8'0"	*	Full Extension
Underfeed	Type "E"	##	##	##	##	6'6"	8'6"	7'6"	9'0"	--
Underfeed	Jones	36"	38"	40"	42"	6'0"	8'0"	7'0"	8'6"	Min Diam:
Underfeed	Detroit	42"	44"	46"	48"	6'6"	8'6"	7'6"	9'0"	Furnace 36"
Underfeed	Taylor	##	##	##	##	6'6"	8'6"	7'6"	9'0"	--
Underfeed	Sanford-Riley	##	##	##	##	6'6"	8'6"	7'6"	9'0"	--
Underfeed	Westinghouse	##	##	##	##	6'6"	8'6"	7'6"	9'0"	--

NOTES

* Combinations not recommended as smokeless settings.
-- Not adapted to water tube boilers.
\## Combinations not ordinarily met with in practice.
** Omit double arches—using only deflection arch.
Setting heights for Jones stoker refer to standard stoker.

The accompanying table is intended to show the minimum setting heights for the various combinations of boilers and furnaces found in use in Chicago.

These settings are not intended for high capacities, but have proven satisfactory for normal loads where draft is sufficient and proper methods of operation used.

The setting heights shown for side feed stokers are for furnace widths of 7' 0" or less. For wider furnaces the heights must be increased to allow for increased arch spring necessitated by the wider span.

Combinations of vertically baffled water tube boilers noted as not being recommended as smokless settings have been found in actual operation to produce too much smoke to comply with the smoke ordinance in its strictest interpretation, and have proven unsatisfactory from the Smoke Inspector's viewpoint.

Progress of the Smoke Abatement Campaign.

Since the beginning of Chicago's development as a great industrial center, the city has had to cope with the smoke problem. The expansion of the various industries, spreading all about the city, and the development of the world's greatest railroad center, has made this problem more and more complex and difficult of solution. When we consider that approximately thirty million tons of coal are burned annually in Chicago, of which amout eighty percent is bituminous, high volatile coal, the difficulty of accomplishing this with clean chimneys can be realized.

Agitation against the smoke evil dates as far back as 1874, and since then smoke ordinances have been passed by the city councils and various campaigns for pure air started. In September, 1919, the Mayor, by executive order, authorized the Commissioner of Health to direct the work of the Department of Smoke Inspection and a few months later, the city council passed an ordinance consolidating the Smoke Inspection Department with the Department of Health.

A vigorous campaign for smoke elimination was instituted in September, 1919, and a smoke abatement week was promulgated, at the start, securing the cooperation of all fuel users, including railroad interests, power and heating plant owners, municipal plant operators, marine interests, the Janitors Association, and civic organizations.

A Board was established for hearing complaints against railroad locomotives and this board, known as the "Railroad Smoke Abatement Board" composed of railroad officials, representatives of the Brotherhoods of Locomotive Engineers and Firemen, and representatives of the Department of Health, has been functioning every two weeks, threshing out a large number of complaints, at which hearings the locomotive engineers and firemen, as well as the railroad companies were given an opportunity to explain the cause of the violation of the smoke ordinance before final judgment was passed by the Board. A marked improvement in the operation of locomotives in the city limits has been noticeable since the establishment of this Board.

A hearing board to investigate complaints of smoke from stationery power and heating plants was also instituted, resulting in a large number of abatements without the necessity of bringing Court proceedings for the abatement of these nuisances.

Since September, 1919, the records of the Smoke Bureau show that during this period hundreds of violators have been sued and fined, fires have been drawn from under the boilers of a large number of plants and the smoke nuisances summarily abated in several public schools. In other instances, the man in direct charge of the offending equipment, has been haled into Court by process of warrant and punished for permitting violations of the ordinance. The city of Chicago was fortunate in this campaign by having the hearty cooperation of the Janitor's Union of 7,000 men, with the result that there was a very noticeable improvement in the behavior of the chimneys of the apartment houses in the residence districts.

The fore-word of the annual report of the Dept. of Health for the year of 1919, states that:

> "An unrelenting campaign is being waged for fresh air, more and more sleeping porches have been constructed, more and more windows are being opened for the admission of outdoor air, but the great battle ahead is to eliminate the smoke nuisance. One should view that individual who poisons his ocean of air through the same glasses that he looks upon him who ruthlessly contaminates his lake of drinking water. When the people of this community are awakened to the fact that life is shortened, both directly and indirectly, by the large deposits of carbons that are constantly being inhaled and implanted in the tissues of the lungs, they will restrain all who are responsible for such conditions."

Under the smoke ordinance, the department not only maks observations of smoke emission from the chimney and prosecutes for violations of the ordinance, but also supervises the installation of all fuel burning equipment and this feature of the ordinance has resulted in the installation of modern smokeless equipment in new plants and in the elimination of obsolete, inadequate boilers and furnaces in old plants which have been persistent violators in the past. The outook for the future promises that Chicago's air conditions will improve, as better fuel burning equipment is supplied and as the unsettled fuel condition stabilizes. These two factors together with an improvement in the labor situation will make for better air conditions in Chicago.

The records of the Health Department show that since the taking over of the Smoke Department, the percentage of deaths from Pneumonia, in proportion to population, has been less than in previous years. This improvement is attributed partially to the purification of the air due to the abatement of the smoke nuisance.

In conclusion, it can be said, that the smoke nuisance can be reduced to a minimum by the support of an informed public and the rigid enforcement of the smoke abatement ordinance.

MODERN AIR TEST METHODS

By DR VERNON HILL, Aerologist.

The American Society of Heating and Ventilating Engineers recently adopted the Synthetic Air Chart as the standard method for determining the degree of perfection of air conditions in an occupied, enclosed space. The chart (designed by the writer) was offered to the profession some years ago as a means of measuring with a greater degree of accuracy than heretofore the air conditions maintained in any given room. Instead of speaking of the ventilation of a room as good, bad or indifferent, etc., the results of tests are plotted on the chart and the air conditions are recorded as a percentage of perfect. This is done by considering all of the known factors that make up the air conditions. These factors with their proper weights, experimentally determined, are arranged in columns vertically across the chart. The base of each column represents the ideal condition, or 100% perfect. Bordering on either side of the main columns are two narrow columns marked, "+%" and "— %," the minus percent denoting the penalization to be subtracted from the percentage of perfect column and the plus percent denotes the condition considering only the one particular factor. These various factors are divided into three groups:

First, wet bulb difference, which includes temperature, humidity and air motion. Second, dust, bacteria and odors. Third, carbon dioxide which is considered in relation to the air supply. In addition, columns entitled "Other injurious substances" and "Distribution" are inserted. The upper limit of any of these groups represents the condition where life would cease to exist, hence at this point the "— %" column would indicate 100% penalization. (Since the upper ends of the columns represent conditions that are not found in practice they are not included in the chart.) The lower limit of any of these groups represents ideal or perfect conditions, hence at this point the "— %" column is indicated by 0.

To illustrate the method of graduating the columns, consider the first, which is headed "Wet Bulb Difference." When at rest with no air motion the ideal wet bulb temperature is 56°. The upper portion of the column represents the unlivable condition, which is approximately 106° with 100% humidity. This gives a wet bulb difference of 50°. Any variation from 56° will, therefore, represent a definite percentage of variation from the ideal, 56° being 100% perfect or 0 in penalization, and 106° being 100% penalization and 0% perfect. The graduations in the other columns were constructed in a like manner.

A short description of the methods employed in making air tests may be of interest to the reader.

By examining the Synthetic Air Chart it will be noted that there are five primary columns, namely:

1. Temperature, humidity and air motion.
2. Dust.
3. Bacteria.
4. Odors.
5. Carbon dioxide.

and it is necessary that tests of the air be made to determine these five factors.

1st.—Temperature, Humidity and Air Motion:

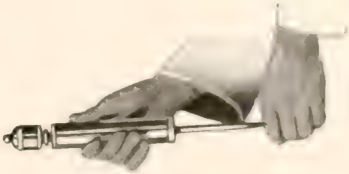
The temperature and humidity of the air are determined by means of a whirling psychrometer. This instrument is composed of two accurate mercury thermometers, the bulb of one being covered with a cloth wicking which is immersed in clean water before the test is made. The thermometers are

whirled in the air about one minute. The thermometer with the uncovered bulb gives the dry bulb temperature of the air. The one with the wicking gives the wet bulb or evaporation temperature. From the psychrometric chart the humility is readily determined.

The air motion is measured by an apparatus called the A C machine. The apparatus consists of two bottles, one containing hydrochloric acid and the other ammonia. A small pump forces the vapors from these liquids into the glass mixing tube where they unite forming a dense white cloud of ammonium chloride. The rate and direction of travel of this cloud determines the air motion and also gives valuable information as to the direction and behavior of air currents.

2nd.—Dust:

The dust content of the air is found by directing a current of the air against a glass plate covered with an adhesive mixture. This is done by means of a hand exhaust pump drawing the air through a capsule containing the glass slide (see illustration). The slide



is afterwards removed from the instrument and placed on the stage of the microscope and the number of dust particles in a unit volume of air counted.

3rd.—Bacteria:

The relative number of bacteria in the air is found by exposing a glass plate contain-

ing a nutrient media on which bacteria develop. They are exposed to the air for two minutes, incubated until the bacteria colonies develop.

4th.—Odors:

Odor determinations are made by means of standard odor solutions which are rated as:

100% free from odors.
95% very faint.
90% faint.
85% noticeable.
80% distinct.
75% decided.
70% strong.

The observer immediately upon entering the room from the outside sniffs the air and compares his odor perception of the same with the different solutions, selecting the one which compares the closest with his original odor perception.

5th.—Carbon Dioxide:

Carbon dioxide determination is obtained by means of a small glass tube in which the air samples are taken, called the Cotometer. The bulb contains a measured quantity of an alkaline solution which absorbs the carbon dioxide from the air. After the bulb containing the air samples has been shaken for about one minute a measured amount of the acid is added drop by drop until the color of the solution in the bulb disappears. The number of drops used determines the amount of carbon dioxide in the air.

Distribution, which is the sixth column in the chart, is not a factor in itself but a test of how well the air supply is circulated or distributed throughout the space. It is determined by finding the variation of the carbon dioxide content in various portions of the air from the average carbon dioxide content of the room as a whole.

The results of the foregoing tests are plotted on the chart and the penalization factors given at the right of each column are then added and subtracted from 100. This gives a percentage of perfect air conditions in a room and this result is plotted in the last column of the chart. By this method problems of ventilation are removed from the realm of individual opinion and guess work and placed upon a much more satisfactory scientific basis.

After the values of all the factors have been determined by test the results are plotted on the chart by a heavy vertical line, preferably in red ink, ⅛" wide, and the height of the line will indicate the results obtained in the test. Penalization for all the factors will then be read directly opposite the top of each line. All the minus percentages are then totaled and the sum subtracted from 100% to determine the percentage of perfect ventilation for the room as a whole. This result is plotted in the last column headed "Percent of Perfect."

The theory of the chart is to take all the known factors into consideration that influence air conditions and to indicate by the plotted lines how far these conditions vary from the ideal. Some may be satisfactory while others may be so far from the ideal as to bring the total percent below desirable. It is, therefore, easy to determine which conditions need correction. The ideal is 100% on the chart, while the unlivable is zero.

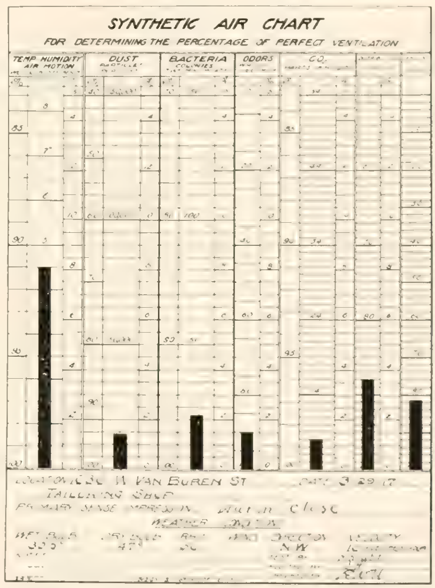
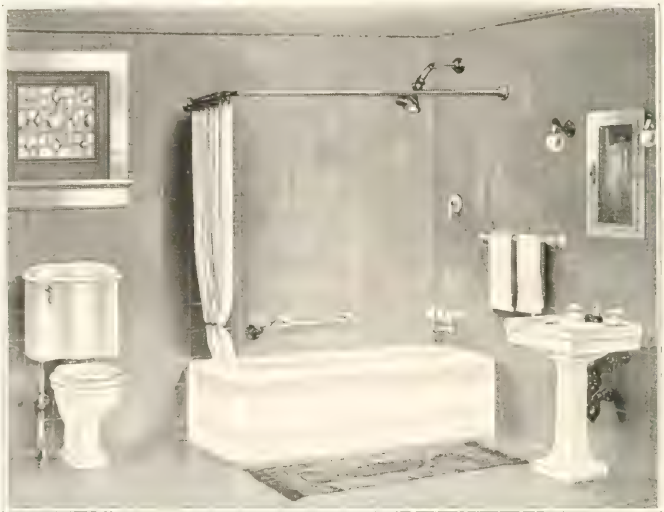


Chart of Test in a Tailor Shop.

The chart illustrated herewith is from a test in a tailoring shop in Chicago. The room tested was ventilated by means of windows on opposite sides of the room, north and south. The total window area is 600 square feet and the room is 100 by 80 ft., with an 11-ft. ceiling. Heat is supplied by direct radiation placed beneath the windows. There were 110 persons employed in the room, engaged in the manufacture of clothing. The chart gave a final percentage of nearly 82, which is too low for health and comfort.

The points to be criticized in the air conditions in the room are shown principally in the first and next to the last columns. The first column shows an exceedingly high wet bulb temperature, due to the use of gas heated irons. The next to the last column, namely, the distribution column, is also bad, as is frequently the case where particular attention is not given to this factor.



MODERN SANITATION OF BUILDINGS

By LEO H. PLEINS, Architect and Sanitary Engineer

The primary object of this article is to present to Architects in as brief a form as possible, data, which the writer trusts may be of service in their office practice in the preparation of plans and specifications covering plumbing work.

The great importance of sanitary plumbing work is daily becoming more and more recognized and hence if the Architect is to give his client full service, plumbing must be given the same careful consideration as the other structural parts of the building.

For convenience of reference the article is arranged under four headings—"Drainage of Building";—"The Water Supply";—"Arrangement of Toilet and Bath Rooms"; and "Plumbing Fixtures". Space does not permit of covering all that may be said under each heading, but endeavor has been made to mention characteristic features of importance, that should be given consideration in the proper analysis of each particular problem.

DRAINAGE OF BUILDINGS.

I. **Proper Fall to Main Sewer.** When a survey is made the location and size of main sewer should be indicated thereon. If stubs to curb are in place their location, size and grade should be shown. The basement floor grade should always be given and also grade of main sewer at curb or street. The desirable grade for house sewer connections is ¼" to one foot. If this cannot be obtained, the grade may be reduced but in this case the size of the tile pipe must be increased according to the length of the connection from building to main sewer.

See Table I for carrying capacity of tile pipe at varying grades. Discharge is given in cubic feet per second. Convert this into gallons by multiplying by 7.50

II. **When Main Sewer is Above Level of Basement Floor Grade:** In this case all drainage from floor drains or fixtures in basement must be run to a sump basin and elevated by means of a pump. If no water closets or urinals are to be installed in basement the pump will be described as a **bilge** pump. If water closets and urinals are to be provided in basement, the pump will be described as a **sewage ejector.**

Obviously all waste and soil lines that may be drained by gravity, such as all drainage from floors above the basement shall be run into a horizontal line and this carried under ceiling of basement and thence through the wall connecting to the main sewer at such distance below grade as necessary to properly drain the system. The discharge from Bilge Pump or Sewage Ejector shall be connected into the horizontal line under ceiling of basement at such point inside of building as may be convenient.

If a Bilge Pump is installed—the basin for a single pump should be as follows: For pump from 10 to 30 gallons per minute, basin to be 30" diameter; for a pump from 50 to 100 gallons per minute, basin to be 36" diameter and for a pump from 125 to 200 gallons per minute, basin to be 42" diameter. For two or duplex pumps—basin to be 48" diameter for pumps from 100 to 125 gallons per minute and 60" in diameter for pumps of 150 to 200 gallons per minute capacity. All basins should be 36" deeper than lowest inlet entering the same.

If a Sewage Ejector is installed, the basin for a single ejector shall be as follows: For an ejector from 50 to 75 gallons per minute —basin to be 36" in diameter; for an ejector of from 100 to 200 gallons per minute, the basin should be 42" diameter and for an ejector of 250 to 350 gallons per minute, the basin should be 48" in diameter. For two or duplex ejectors, the basin to be 48" in diameter for ejectors of from 50 to 100 gallons per minute and 60" in diameter for ejectors of from 125 to 350 gallons per minute. All basins should be 48" deeper than the lowest inlet entering the same.

The best motive power for Bilge pumps or Sewage ejectors is a direct connected vertical type electric motor—the operation of which is automatically controlled by means of a float switch.

Wherever possible, both Bilge pumps and Sewage ejectors should be installed in duplicate sets. With duplex pumps the automatic control is arranged so that the same will start one pump when the water level has raised, holding the second pump in reserve, and starting the second pump when the first is not capable of handling all the water. Both pumps will then operate until normal condition has been restored. The automatic control should be provided with a four-pole transfer switch so connected up that by throwing over switch, each pump will operate at alternate periods, holding the other as reserve and in this way, equalize the wear on the pumps.

Always ascertain and specify the correct electric current and provide for service wires to within 5 feet of pump to be furnished by contractor for Electrical Work. If current is Direct give the voltage and if current is Alternating give voltage cycles and phase.

The motors for pumps are usually mounted on a cast iron or steel plate which forms a support for motors, contact apparatus etc. The basins may be of cast iron, steel, brick or concrete. If of the latter materials basins must be thoroughly waterproofed.

A swinging check valve, cast iron body, brass mounted must be placed in the horizontal discharge pipe between pump and sewer.

Blow-off drainage from boilers cannot be run directly into bilge pump or sewage ejector basins—but must always discharge into a cast iron or steel blow-off basin or muffler tank. From this basin the drainage may then be run to bilge or sewage ejector basins, if it is impossible to drain the same by gravity.

copper or lead sleeve. Roof fittings and strainers should be of cast iron and well flashed with copper or lead.

"Josam" or "Holt" roof strainers of proper size and type make the best roof strainer connections.

To determine the proper size for downspouts the following may be of service.

A rainfall of 1-inch in depth on an area of 100 square feet will give a run off of 62 gallons.

Diameter.	Slope, or Head Divided by Length of Pipe.							
	1 in 40	1 in 70	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600
5 in.	.456	.344	.288	.204	.166	.144	.137	.118
6 in.	.762	.576	.482	.341	.278	.241	.230	.197
8 in.	1.70	1.29	1.08	.765	.624	.54	.516	.441
9 in.	2.37	1.79	1.50	1.06	.868	.75	.717	.613
Slope	1 in 60	1 in 80	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600
10 in.	2.59	2.24	2.01	1.42	1.16	1.00	.90	.82
12 in.	4.32	3.74	3.35	2.37	1.93	1.67	1.5	1.37
Slope	1 in 100	1 in 200	1 in 300	1 in 400	1 in 500	1 in 600	1 in 700	1 in 800
15 in.	6.18	4.37	3.57	3.09	2.77	2.52	2.34	2.19

Boiler Blow-Off Basins:

These are usually included under the heading of "Heating Work." The contractor for this work makes all connections between same, boiler blow-offs, drips, etc. When directly connected to the house sewage line the plumbing contractor makes such connection as also the venting of blow-off basins through roof. Attention in this connection is called to the requirements of the Chicago Ordinance prohibiting the discharge from basins being made into tile sewers within any building, furthermore, that the water discharged into a sewer shall not exceed 120° "F." It is necessary therefore to use cast iron pipe and in order to prevent leaks of joints, therefor cast iron hub and spigot pipe should be made with iron cement instead of lead—or flanged pipe used with asbestos graphite gaskets.

The following Table (II) may be of service to determine the proper size of basin to be provided:

Table II.

For Boiler of 25 to 75 H. P. use Basin 42″ diameter by 60″ deep.
For Boiler of 100 to 200 H. P. use Basin 48″ diameter by 72″ deep.
For Boiler of 250 to 400 H. P. use Basin 60″ diameter by 72″ deep.

For more than 400 H. P. use two or more basins—using the above as multiples according to horse power of boiler.

Downspouts and Downspout Drains:

In many localities the drainage from downspouts must be connected into a "Storm Water Sewer"—and not to the "Sanitary or house sewer." In either case arrangement of downspouts and drainage from same may be the same.

The best material to use for vertical inside downspouts is extra heavy cast iron pipe and fittings of proper size. All outside sheet metal downspouts should be connected into cast iron pipe and fittings above grade and cast iron pipe be run to proper depth below grade and connected to tile pipe by means of a cast iron quarter-bend.

Before making connection to roof—downspouts should be increased one size and the roof connection should be made to allow for expansion and contraction by means of a

Downspouts proportioned as follows have been found in practice to give satisfactory results. For small roofs, 1 sq. inch in sectional area of the leader for each 150 sq. ft. of roof surface. For medium sized roofs 1 sq. in. in sectional area of the leader for each 200 sq. ft. of roof surface. For large roofs, 1 sq. inch in sectional area of the leader for each 250 sq. ft. of roof surface.

Judgment must be used in arranging downspouts so as to equalize the square feet of drainage as nearly as possible.

Outside downspouts should be avoided, especially in cold climates, as they are constantly giving trouble on account of freezing and therefore cause damage to roofs and walls.

Where roofs are covered with gravel or in localities where high winds are likely to cover roof with debris, etc., the downspouts should be provided with cast iron gravel basins or running traps with cleanouts. Gravel basins or traps must always be used when connecting downspout drains to sanitary sewers, where ordinances do not require such downspout drains to be run into outside catch basin as required by the Chicago ordinance.

Size of Main House Drain:

The size of the main house drain when serving as a combination drain (sanitary and rain water) may for all practical purposes be determined by the total surface area covered by the building or buildings and paved surfaces to be drained, by the following table, which is based on cast iron pipe. If vitrified tile sewer pipe is used the diameter of pipe as given must be increased one size for same area of drainage.

Square Feet of Drainage Area.

Diameter	Fall ⅛ in. per foot	Fall ¼ in. per foot	Fall ½ in. per foot
4 inch	1.500	1.800	2.500
6 "	3.000	5.000	7.500
8 "	6.000	9.100	13.600
10 "	9.000	14.000	20.000

Back Water Valves:

Whenever the grade or size of sewer in street is such that there is a possibility of the same backing up—the house sewer must be provided with a cast iron back water valve of approved type and this valve should

be placed in a manhole or otherwise located so as to be accessible for inspection or repair. It is desirable to use a back water valve having a flushing connection so that the line may be flushed.

Flush Tanks:

Whenever the sewer in street to which connection must be made forms what is known as a "dead end" it is desirable to provide a flush tank which when filled to a proper height with clean water, will automatically discharge the contents into the sewer and thereby keep the sewer free and prevent obstructions that might otherwise occur. These flush tanks may be of two types—as illustrated herewith. Type A being suitable for flushing more than one dead end; Type B may be used if the "dead end" will be continued at some later time—in which case the flush tank may be converted into a standard manhole by taking off the cap at end of siphon and removing the latter.

Soil Pipe System:

Cast iron extra heavy soil pipe and fittings are the most permanent and best for soil, waste and vent systems and should be used wherever possible. While the ordinances of some cities require the use of wrought iron pipe where buildings are over seven stories in height, there is no reason why this exception should be made, as extra heavy cast iron soil pipe and fittings have been used in buildings 16-stories in height and the joints double calked as described on page 457. (?)

The very best and most durable material for soil, waste and vent systems is full iron pipe size annealed brass pipe with red metal cast brass fittings. However, the cost of such an installation is usually greater than most owners care to invest.

Considering such ordinances as require the use of wrought iron pipe for soil, waste and vent systems, we would say, that unfortunately these ordinances are not specific in stating that when wrought iron pipe is used—it shall be Genuine Wrought Iron, hence most installations are made with commercial steel pipe, which in the opinion of the writer should never be used. In many cases where the question of cost of genuine wrought as compared to steel has been an issue—Architects and Engineers have expressed the opinion that genuine wrought pipe was not worth the difference in cost. This opinion is not shared by the writer but as stated above, I believe, that extra heavy cast iron soil pipe is the most logical material to use when all facts are taken into consideration.

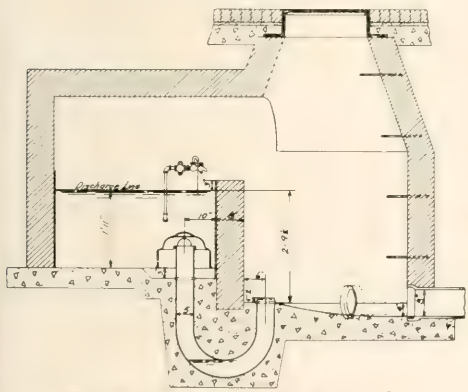
In the opinion of the writer there is a great opportunity for manufacturers of cast iron pipe to perfect a system that may be installed using cast iron threaded pipe with cast iron threaded fittings. This should make absolutely the best piping system for every class of work. The threaded pipe and castings would naturally be easier to install than cast iron soil pipe and fittings with double calked joints.

If Genuine Wrought iron pipe is used for soil, waste and vent piping—all vent extensions up thru roof should be terminated with extra heavy cast iron soil pipe—the length of which should not be less than 10 feet if possible.

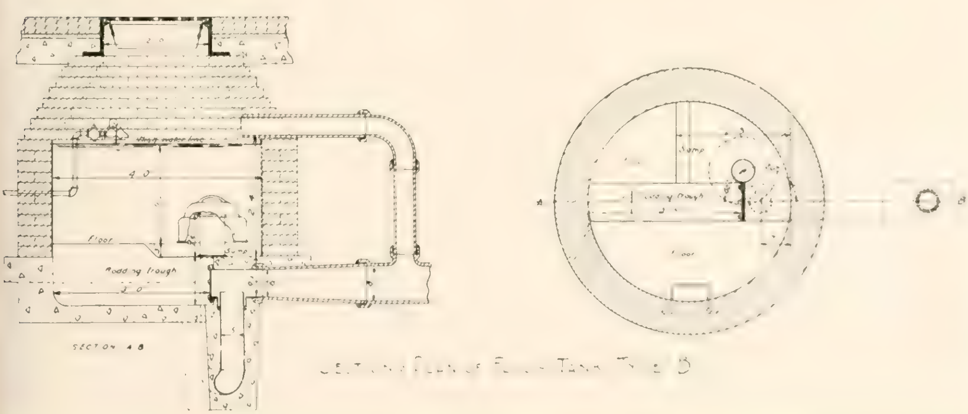
Simplicity in arrangement of soil, waste and vent stacks is desirable and it is extremely desirable to make diagrams of the system that will be of aid to the plumbing contractor as well as of being of service to the other contractors on the work. In order to be of service these diagrams must be accurately drawn and amplified by details where necessary.

The importance of a plumbing plan carefully laid out has unfortunately not been properly recognized. At the present time the cost of material is such that the Architect who is going to give his client the service for which he is paid—must more than ever consider every item that will form a part of the work.

The structural parts of a building are carefully analyzed, weights of steel columns, girders, etc., proportioned to the loads they must carry, and all this work carefully detailed—and still the plumbing work is very rarely even laid out beyond a mere indication of the main run of soil or sewer lines—on the basement or foundation plan.



SECTION OF FLUSH TANK TYPE 'A'.



SECTION AND PLAN OF FLUSH TANK TYPE B

Specifications very often contain a clause requiring the successful bidder to submit a piping plan for the Architect's approval before commencing work. They might just as properly contain clauses asking the successful bidders to submit details for the elevations of the buildings, etc., etc. It is the Architect's duty to secure the best proposition possible for his client and therefore the plumbing work should be drawn—detailed and specified in such a manner that all bidders on the work may estimate on the same fixed basis and not permit them to submit figures based upon their ideas and conception of what may be required for the work. Such methods are very unsatisfactory and can only result in misunderstanding and most frequently in absolute failure at the expense of the client.

Whenever wrought iron pipe and cast iron drainage fittings are used, either asphalted in and out or galvanized—the stacks should be placed in pipe shafts so that the piping may be inspected and sections replaced when necessary without disturbing walls and partitions. All vents through roof should be of extra heavy cast iron soil pipe for a distance of not less than 10 feet below. Never place wrought iron pipe under basement floors. All such drainage pipe must be of extra heavy cast iron soil pipe and fittings.

When the building covers considerable area—it is desirable to use cast iron or waterproof concrete catch basins on the main lines and at intersections so as to permit of rodding the lines. In place of catch basins—large cleanouts may be used—which must always be the same size of pipe up to 6″. Such cleanouts should be placed in manholes with cast iron covers large enough so that the lines can be rodded properly. Cleanouts must be placed at the foot of all stacks and wherever a change in direction of a horizontal line occurs. Cleanouts for best work should be of the heavy brass bell ferrule type with brass trap screw. With ferrules of iron the brass trap screw rusts in so that it is difficult to remove the same.

Changes in direction of horizontal lines should always be made on as full a sweep as possible, using Y-branches and 45° bends.

Connection between vertical stacks and horizontal drains in basement must always be made by means of Y-branches and 45° bends. Connection between horizontal lines on upper floors may be made by means of sanitary tees—although Y-branches are better.

All horizontal soil and waste lines should have a fall of ¼″ to the foot toward outlets where possible.

All horizontal vent lines must be pitched so that water of condensation will drain freely into soil and waste lines or stacks, and foot of all vent stacks must be connected into a main soil or waste line or stack.

Reventing of each plumbing fixture is generally required. The Chicago ordinance prescribes this; other localities permit circuit venting and hence, the Architect must necessarily familiarize himself with the requirements of ordinances that may be in force in the locality in which his building is to be erected.

All main vent stacks must be extended up through roof. On pitched roofs, the vents may extend above roof 6 to 12 inches, on flat roofs 18 inches to 2 feet will be better in order to be safe in case of heavy fall of snow and to avoid dirt entering same.

In the Eastern, Central and North Western States it is necessary to increase all vent stacks at least one size up to 6 inch before passing through roof. The minimum size vent through roof should be 4 inch. All extensions through roof must be cast iron. Increasing stacks makes it possible to turn down lead or copper flashing into the pipe and leaves the extension free to provide for expansion and contraction. While caps or vent cowls should never be placed on top of vent stacks, it is desirable to use a strainer of cast iron of a removable type. Galvanized wire strainers are worthless. See Drawing.

Lead wastes are infrequently used in modern practice so we will only briefly mention them. When lead waste piping is used—it should be of a weight known as "medium" and when connected to wrought iron piping the connection must be made by means of extra heavy brass soldering nipples and a good heavy wiped joint. When connected to cast iron pipe—extra heavy brass bell ferrules must be used, wiped to the lead pipe and calked into the cast iron pipe.

JOINTING OF PIPE must be carefully done. For cast iron soil pipe—the following is a good method.

All joints of cast iron soil pipe shall be made with oakum and pure pig lead, bedded with hammer and calking iron. A gasket of well packed oakum shall be placed at the bottom of the hub extending above the rim of the spigot to prevent the escape of lead. The hub to be filled at one pouring and the lead calked with such force as to make the joint absolutely water tight under a pressure of at least 10 lbs. per square inch. All joints shall be filled at one pouring; if it fails to run full, it shall be dug out and repoured. Lead shall not be covered with paint, putty or otherwise.

Twelve ounces of lead should be allowed for each inch of diameter of pipe or fitting on which joint is made.

For buildings over six stories in height the cast iron soil pipe joints shall be double calked in the following manner: The oakum shall be well braided and before being placed in position shall be oiled and then well calked; then fill in the hub to within ⅜″ of the top with molten soft pure lead and thoroughly calk. After the lead has been uniformly calked, fill in with molten lead to the top of hub and thoroughly calk—so as to make an absolutely perfect joint. All joints showing leaks under testing shall be dug out, repoured and double calked as above.

With cast iron pipe double calked as above, installations have been made in buildings 16 stories in height in which the entire system is still in excellent condition after a period of 27 years.

Joints between lead and cast iron pipe to be made by means of brass ferrules wiped to the lead pipe and calked into hub of cast iron fittings. Joints between lead and wrought iron pipe to be made by means of soldering nipples with hexagon nuts. Joints between wrought iron pipe and fittings to be screwed home into couplings or fittings without the use of any red lead or other compound.

No steam or cast bushed fittings to be used on any drainage or vent work.

Joints of tile pipe shall be made with neat Portland cement. A cleaner to be run through every length of pipe as it is laid so that no mortar used in jointing will adhere to the interior of the pipe. The connection between cast iron and tile pipe shall be made with a collar of concrete 6 inches thick and extending not less than 8 inches on each side of joint. See illustration.

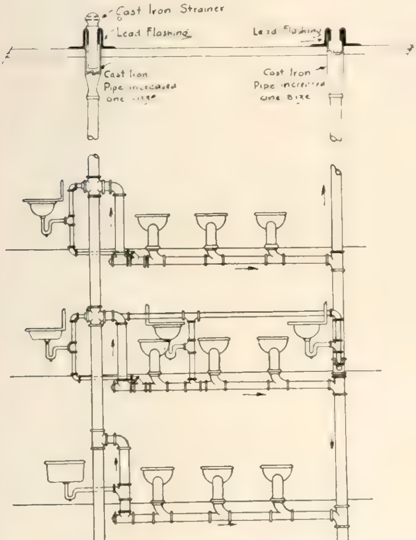
In best work the pipe should always be of genuine wrought iron. Where cost is an item to be considered steel pipe may be used—both kinds should be galvanized and fittings should be galvanized malleable iron—beaded. Plain fittings must never be used.

All soil, waste and vent piping shall be tested. Ordinances usually prescribe the manner of testing which may be by means of water, air, peppermint or smoke on new work.

A lavatory and dressing table of exceptional quality and elegance.

THE slab for both lavatory and dressing table is made of Egyptian Black and Gold Marble. All metal parts are gold plated.

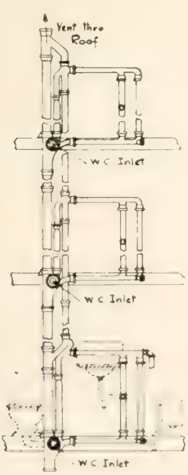
The following illustrations show several methods for reventing plumbing fixtures in accordance with the Chicago practice and also by what is known as the "Circuit Venting" system.

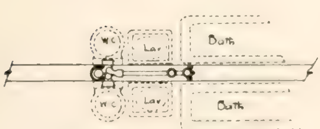


CIRCUIT VENTING
WROUGHT IRON PIPE & DRAINAGE FITTINGS

For good work both water and peppermint tests should be made and if it is desired to be absolutely certain that integrant traps of water closets, etc., are perfect a smoke test may be made after fixtures are set.

In alteration work a peppermint test must always be made.



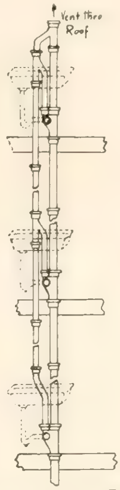


BATH ROOMS - (DOUBLE) ON ONE STACK - USING F & W C I FITTINGS

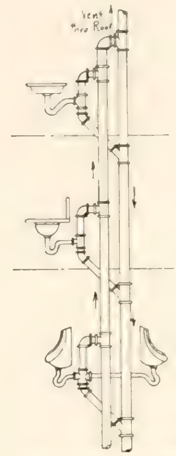
THE WATER SUPPLY

There are so many failures in the water supply system of buildings that it is evident that little study is given the problem which is one of most vital importance.

In order to provide an adequate supply of water for the particular building it is necessary to analyze the actual requirements based on a per capita consumption per day—and another factor that enters into the problem is the pressure under which the water will be delivered.



SINK STACK, USING F & W.
CAST IRON FITTINGS.

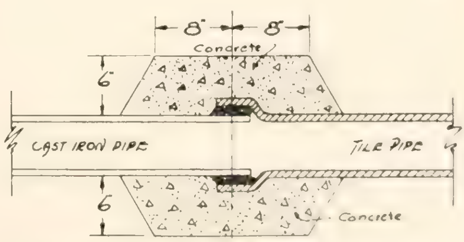


W I PIPE & DRAINAGE F...

Per capita requirements may be determined by the following tables, which are the minimum:

Schools (not boarding) 50 gallons per capita per day.

Industrial Plants & Factory Buildings—50 gallons per capita per day.



METHOD FOR JOINTING C I to TILE PIPE

This does not include water that may be required directly in connection with plant operation in various manufacturing processes.

Hotels, Hospitals, Asylums, Sanitariums—150 to 200 gallons per capita per day.

Homes for the Aged, Orphan Asylums, Boarding Schools, Dormitories—100 gallons per capita per day.

To the above must be added water for sprinkling lawns, etc., which must be based on the flow in gallons per minute of each ¾" lawn sprinkler installed allowing for a

Watrous Sanitary Plumbing Equipment

Fig. C266
Showing Waltank Open
(Wall Closet)

Fig. C266
Showing Waltank Closed
(Wall Closet)

Fig. C366
Showing Waltank Closed
(Floor Closet)

Watrous Patent Waltank Closet Combination

For the first time a Wall Closet can be used successfully with a "Low Down" tank. This long wished for result is made possible by the new Watrous Patent Low Waltank and Watrous Syphon Duojet Wall Closet.

Formerly the wall closet could only be used in office buildings and public institutions, and they required large piping, high pressure, flush valves and special drainage systems. Now architects and builders welcome the combined advantages of the suspended wall type of quietly-operating closet installed with regular piping, low pressure, low tank adaptable to any drainage system—to be found in the Watrous Syphon Duojet Wall Closet.

ITS GREATER SANITATION facilitates cleaning. There are no exposed metal parts to rust or corrode, and the wall connections are all gas-tight. It is ACCESSIBLE—can be disconnected and removed in 1½ minutes. Fits easily in any regular partition, connecting with lead, cast iron soil or threaded wrought iron pipe.

ECONOMY OF WATER—A 3-gallon low tank thoroughly, quickly and quietly cleans the bowl, and provides an ample refill and water seal. THE SPACE SAVED in the bathroom is important. From eight to eleven inches are saved where the wall closet is used, and six or seven inches in the case of floor closets. This is a real factor in constructing modern homes and buildings.

FLUSHES QUIETLY. Being concealed in the wall, all noise due to flushing and refilling is muffled and hushed. THE ATTRACTIVE APPEARANCE of the Waltank, made of vitreous smooth white china, blends ideally with any form of decorated wall.

Architects and builders will meet with a ready response from their clients when they explain and specify the Watrous Waltank Closet Combination.

Watrous Lavatory Waste

The most simple, easily adjusted waste yet developed. Only one-third as many parts as any other. There is no bending of parts to install. Fits any type of enamel iron, porcelain or vitreous lavatory.

The operating Rod has a universal ball joint which allows for distance variations between the two lavatory openings, and a series of holes in the shank of the stopper plug, takes care of varying thicknesses of lavatory openings.

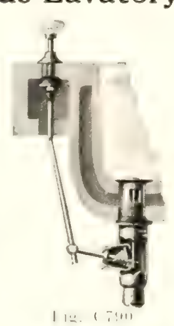


Fig. C790

Open or closed, the action is always positive. The drain area empties three times as fast as the ordinary waste, saving time. Conical Expansion Spring minimizes friction and adjustments.

Of special interest to Architects and Builders, who will find prospective building-owners very appreciative of this time-saving and efficient Lavatory Waste.

THE IMPERIAL BRASS MANUFACTURING CO.

1232 West Harrison Street — CHICAGO, ILL.

period of 3 to 4 hours for each sprinkler as a fair average.

Having determined the total quantity required for 24 hours—the next thing to determine is the proper pressure required for the work and in working this out the following must be considered:

If the average pressure is not sufficient to deliver water on the top floor of the building under at least 20 lbs. maintained pressure, it is advisable to provide a pumping system to increase the pressure so as to maintain an average of at least 20 lbs., on the top floor.

It is always advisable to install pumps in duplicate sets in larger installations.

Where city pressure is not constant and less than 20 lbs., it is advisable to install a surge tank from which the pump is supplied. The tank should contain not less than 10 times the water of the pump capacity per minute. Supply to tank should not be less than 2″ and supply controlled by a float valve.

All pipe up to 2½″ should be provided with unions with brass seats—for best work and for over 2½″ flange unions should be used. Gaskets should be of "Rainbow" packing or better.

All fittings over 2½″ should be flanged.

Valves should be heavy type brass double gate valves up to 2½″ and iron body bronze mounted flanged end for larger sizes. Valves should be of the "rising stem" type for the reason that with this type it can be quickly observed if the valve is "open" or "closed".

For service pipe to building—extra strong lead pipe may be used for sizes up to 2½″. For larger sizes cast iron hub and spigot water pipe of proper weight should be used. When cast iron pipe is brought into the building and up through floor the same should terminate in a flanged end fitting about 12″ above floor.

The following tables may be used to advantage in determining the sizes of main and branch supplies for buildings:

Equalizing Table of Areas of Taps

PIPE SIZES, INCHES	½	¾	1	1¼	1½	2	2½	3	4	5
½	1	1.7	2.8	4.9	6 6	11.	15.6	24.	32.	65.
¾		1.	1.6	2 6	3 8	6.2	8.9	13.8	23.	37.
1			1.	1.7	2.3	3.8	5.5	8.5	14.	23.
1¼				1.	1.3	2.2	3.1	4.9	8.	13.
1½					1.	1.6	2.3	3.6	6.2	9.7
2						1	1.4	2.2	3.8	5.3
2½							1.	1.3	2 6	4.1
3								1.	1 7	2.7
4									1	1.6
5										1

Equalizing Table of Delivering Capacities of Pipes

DIAMETER, INCHES	¾	1	1¼	1½	2	2½	3	4	5	6
½	2 27	4.88	8.49	15.8	31.7	52 9	96.9	205.	377.	620.
¾		2.05	3.43	6.97	14.0	23.3	42.5	90.4	166.	273.
1			1.62	3.45	6.82	11.4	20.9	44.1	81.1	133.
1¼				1.69	2.67	5.94	11.6	23.7	47.4	78.5
1½					1.26	3.34	6.13	13.0	23.8	39.2
2						1.67	3.06	6.47	11.9	19.6
2½							1.83	3.87	7.12	11.7
3								2.12	3.89	6.39
4									1.84	3.02
5										1.65

Gallons per Minute Delivered From Circular Openings at Mains Under Various Net Pressures

HEAD, IN FEET	Pounds Pressure	DIAMETER OF OPENING, INCHES								
		¼	⅜	½	⅝	¾	1	1¼	1½	2
10	4.33					33	56	91	131	224
20	8.66	.5	12	21	32	46	82	123	185	328
30	13.09					57	101	158	226	404
40	17.32	7 5	16	30	46	66	112	182	262	466
50	21.65					73	130	206	299	520
60	25.95	9	20	36	58	80	143	223	329	572
70	30.28					85	154	239	348	616
80	34.65	10	23	41	64	92	164	258	370	656
90	38 98					97	173	271	391	692
100	43.31	11.	26	46	72	104	184	288	415	736
110	47.64					109	192	300	432	768
120	51.98	13.	28	50	79	114	202	316	454	808
130	56.31					118	209	325	471	836
140	60.61	13.5	31	55	81	122	217	336	491	868
150	64.97	14.	32	57	87	126	226	353	509	904

From this point on the supply piping shall be of galvanized genuine wrought iron or galvanized steel pipe according to the class of work.

The following suggestion is made to specification writers on the subject of Genuine Wrought Iron and Steel pipe.

Most frequently the specification states that the supply piping shall be of wrought iron pipe and this is the cause of much misunderstanding and frequently the installation of material that is not wanted.

When the phrase "wrought iron pipe" is used, it is commonly taken for granted by plumbing contractors that, the grade of pipe known as "Commercial Steel Pipe" either black or galvanized will be satisfactory. Perhaps in many cases it will be but it frequently happens that the Architect intended that genuine wrought iron pipe was to be used. In order to clarify this matter it is suggested that the specifications designate whether the pipe thruout shall be genuine, wrought iron or commercial steel pipe. In case of the former the words should be added "with the name of the manufacturer" stamped on each length.

It might be stated in this connection that genuine wrought iron galvanized iron pipe should be used in all first class work.

All fittings used on water supply pipe should be galvanized malleable iron beaded fittings.

Where the water supply from City mains cannot be relied upon as sufficient in volume or pressure to supply all fixtures in the building it will be necessary to provide for reserve storage to insure a constant supply, and there are two kinds of systems to be considered—First the one most commonly known, a tank on the roof, and the other and more recent—a compression tank system with a closed pressure tank in the basement. The roof tank system is obsolete and not recommended—for the reason that in order to maintain a pressure of 20 lbs. on the top floor it would have to be elevated 50 feet above the floor to give this result. Furthermore such tanks require special provision to be made for their support, must be enclosed and generally considered from a standpoint of efficiency vs. expenditure, are out of question at the present time.

The best system is a compression tank pumping system—which we shall briefly describe. These systems may be divided in two kinds—one where the pressure of the water is so low that all must be pumped and the other where it is only necessary to increase the pressure for the upper floors—in which case the system is known as the "booster" type.

In the first type the water may be delivered from a well, cistern or city main and depending upon the source of supply a pump designed for that special work must be used. Wherever possible, when pump is within suction lift of the water (20 feet) a centrifugal or turbine type pump with direct connected motor is the best to use. These pumps are of greater efficiency, less noisy and are more economical in operation than piston pumps.

In order to determine the proper size of pump to install we refer to the following table—which should be checked up with the per capita allowance per day previously mentioned.

To apply the above—First ascertain the number of fixtures pump is to supply—be sure to include every kind of fixture. In case any fixtures are supplied direct from city main these should be deducted. Second—Multiply the number of fixtures by the proper decimal that may apply according to the class of building.

Stores & Shops	.75
Office Buildings	.75
Factories	1.00
Apartment Buildings	.5
Hotels	.8
Hospitals	1.00
Schools	.8

The table is based upon an equal number of males and females and the figures represent the gallons per minute per fixture. If the major portion of occupants are females increase pump capacity 25 per cent.

Where more than 150 fixtures are to be supplied pump capacity may be reduced 15 to 25 per cent.

Where actual water requirements have been determined (by meter or otherwise) furnish a pumping unit capable of discharging three times the actual quantity used.

Example—The total number of fixtures to be supplied by pump in an office building is 120. $=120\times.75=90$. Therefore 90 gallons per minute which pump must discharge. Now to determine the head—The water must be elevated 100 feet and develop a pressure of 20 lbs. The actual head therefore will be 150 feet and to this must be added the distance of suction lift, if any, and allowance for loss of head by friction in pipe. If suction lift is 20 feet—this added to 150 makes a total of 170 and allowance for friction, 10 per cent, makes a total head of 187 feet against which the pump would have to work. The problem worked out in this manner and reference to standard catalogues of pump manufacturers will enable anyone to select the proper equipment.

When the system is of the second type or "booster" system—the head against which pump will work is determined by the following method:

Pump location to highest fixture	100 feet
Range from minimum to maximum pressure	100 "
	200 "
Deduct City pressure 25 lbs. in feet —60	60 "
Pump required for a total head of	140 feet

Compression tanks should be installed of such size that the cycles of pump operation do not exceed three to four per hour. To insure this condition the tank should have a storage capacity of 25 to 30 times the capacity of pump per minute. To illustrate for a pump of 90 gallons per minute:—30×90:—$30\times90=2700$ gallons per tank—1/3 to 1/2 of the storage capacity of tank should be filled with air—at maximum working pressure.

The hot water supply for the building should be determined upon the actual requirements to suit the conditions of each case.

For instance—in the case of a hotel with 100 bath rooms—each containing lavatory and bath tub or shower—the demand for hot water is at a peak load—from 6:30 to 8:00 A. M. and 4:30 to 7:00 P. M. with lesser demands at noon and later at night.

To provide for such service a minimum of 30 to 40 gallons should be allowed for each bath room per hour—this with 100 rooms would mean a heater having a capacity of 3000 to 4000 gallons per hour to which must be added the quantity that will be required for kitchens, laundry, etc.

Generally speaking the following table may be used to determine size of hot water supply systems:

Schools (not boarding):

5—gallons per pupil per day for water used in lavatories,

6—gallons per minute for each shower or

25—gallons for each pupil using the shower.

Hospital:

50—gallons per day for each person and add 50% of total for kitchen—laundry and general service.

Hotels:

50—gallons per day for each bath room and add 50% of total for general service.

If there is a Turkish bath in connection with the hotel add 100 gallons for each bather—based upon the capacity per hour of the establishment.

Apartments: Allow 100 gallons per day for each apartment having not more than 2 baths, for each additional bath add 25 gallons and 25% of the total for general service.

Factories: Allow 10 gallons for each employe per day for each wash basin and 25 gallons for each employe using showers.

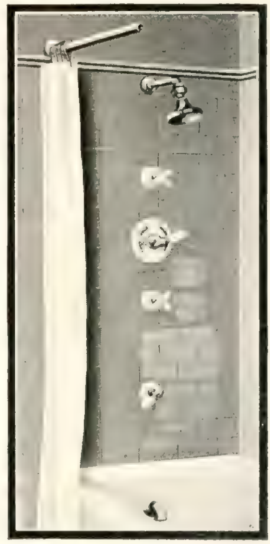
Boarding Schools—Asylums—Homes, etc.: Allow 40 gallons per day for each person. For showers 25 gallons for each user and add 50% of the total for general service.

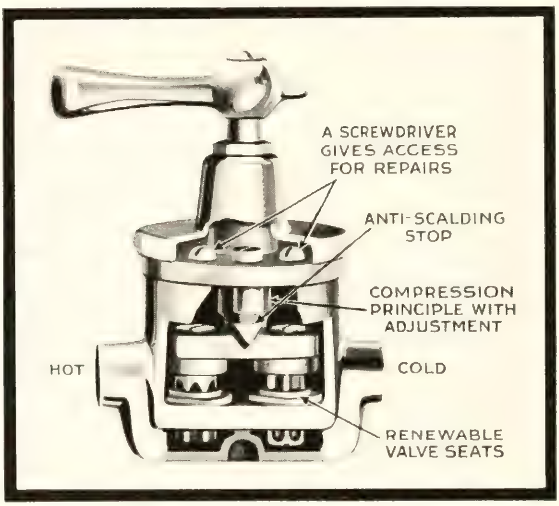
For smaller installations a hot water storage tank with steam coils for winter service and hot water heater for summer service makes a satisfactory installation. The tank should always be provided with a thermostatic control to prevent overheating the water. Tanks with coils should always have a manhole at one end.

THE INCOMPARABLE

NIEDECKEN MIXER

PATENTED





THE RELIABLE
Bath Tub or Shower Supply Control

Supplying water at required temperature almost instantly

Note the Simple Construction and Ease of Repair

FOUR THOUSAND NIEDECKEN MIXERS

Are giving satisfactory service in Statler Hotels

Write for Bulletin H. A. B. 22

HOFFMANN & BILLINGS MFG. CO.
MANUFACTURERS SINCE 1855
MILWAUKEE, U. S. A.

In cases where the heating system is a **vapor** system, the water should be heated by means of a hot water heater the year around, as the pressure of the steam is too low to effectively heat the water by means of steam coils in the tank.

Where showers are used it is desirable to place a thermostatic hot water line control valve in the hot water supply main in order to prevent scalding. It is good practice to separate the system in Hotels, Hospitals, etc., so that the water supplied to bath tubs, lavatories and showers is controlled in this manner. It not only prevents possible scalding but saves fuel and increases the life of valves, faucets, etc., which excessively hot water materially shortens.

In larger installations—especially where both exhaust and live steam (high or low pressure) are available; the hot water system should be arranged in two units; the first a storage tank of proper size, called the primary heater, in which the water is heated by exhaust steam—from this heater it passes to the secondary heater which is provided with coils supplied by live steam under thermostatic control. The latter heater brings the water up to the desired degree of temperature at which the control is set.

Another and most economical type of heater is the instantaneous type—heated by low or high pressure—controlled by an automatic thermostatic device and using only such quantity of steam as necessary to heat the water actually used—to the temperature for which the control is set. This type of heater is very efficient and economical and is especially adapted to large installations as Hotels, Hospitals, Factories and wherever there may be a large variation in the demand for hot water throughout the day or night.

In order to ensure proper results, hot water systems must be in perfect circulation —wherever possible the **overhead** type system should be used with a riser to the top floor—horizontal supply mains and drop supplies to the fixtures on floors below with circulating return in basement. Hot water riser should have an air vent trap at highest point.

Pressure of hot and cold water systems should always be the same.

In some cases circulating pumps are necessary. These should always be of the centrifugal type with low speed motors and if direct current is available, motors should be provided with a variable speed control.

In conclusion of the suggestions for water supply system—I would say that in my experience most mistakes have been made in having the piping system too small and this is especially true in the case of hot water tanks and heaters.

A heater too small for the service will waste more fuel than one too large.

ARRANGEMENT OF TOILET ROOMS AND PLUMBING FIXTURES.

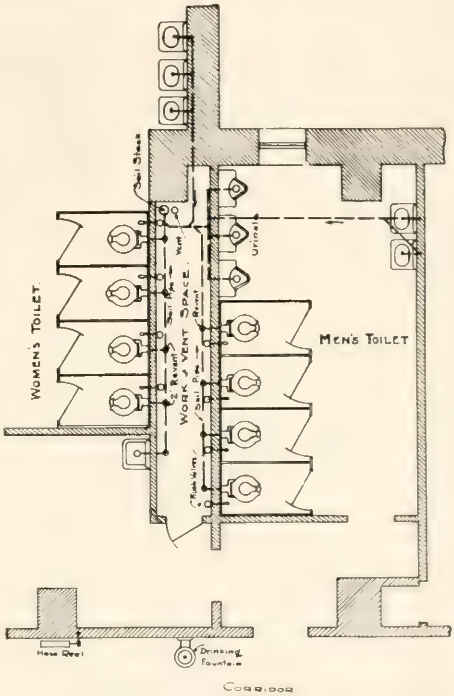
Few Architects realize how much the cost of the plumbing and heating on a building is governed by the design and location of toilet rooms. Many buildings are up several stories before the location of pipe chases or shafts are decided upon and many botched up piping jobs are the result of this neglect.

This again brings up the great need of proper plumbing plans and diagrams—showing the proper size and location of the piping and permitting the general contractor to provide chases in walls—leave openings in floors and provide pipe shafts of proper size for the work.

In residences with wood studs the partition carrying soil pipe must have at least 6" studs and a still better arrangement is to have a hollow space and use 4 or 6" studs flat wise and framed once or twice in their height as this saves cutting of studs for horizontal vent pipes.

If partitions are hollow tile, 6" thick tile should be used. Thin partitions of Mackolite, Pyro Bar or similar gypsum materials make very unsatisfactory partitions for concealment of piping, as no secure anchorage can be had in same for bolts to fasten hangers or brackets for fixtures; furthermore, condensation on pipes dissolves sulphuric acid in gypsum and induces quick corrosion of metal.

With buildings of fireproof construction in which the floors are of reinforced concrete the location of bath and toilet rooms must receive careful study.



Toilet Rooms with Work/Vent Space between Same.

There are three schemes that may be used.

The first, a pipe shaft 2'-6" to 3' in width extending up through the building—in which all piping may be placed and fixtures all provided with wastes and supply connections to wall. (See illustration.) This arrangement is very desirable for Hospitals, Schools, Hotels, Office Buildings, etc.; it makes an ideal arrangement and is economical in cost of installation and maintenance. All pipe being exposed it is easily gotten at in case of repairs.

The second is to raise the floor of toilet rooms 7" to allow for piping being concealed in floor. This is sometimes objectionable and in the case of Hospitals, Homes and Institutions should not be done.

The third is to run the piping under the ceiling of room below—either exposed or concealing the same by furring down the ceiling.

In planning toilet rooms it is most important to ascertain the exact size of the various fixtures that are to be installed—so that these will be placed properly and to the best possible advantage.

This is especially necessary in the case of bath tubs and shower stalls. If recessed tubs are used, the exact length overall, distance the ends and back will extend into wall must be considered as there is always a difference between the nominal size of bath tub and their actual overall length; the end at

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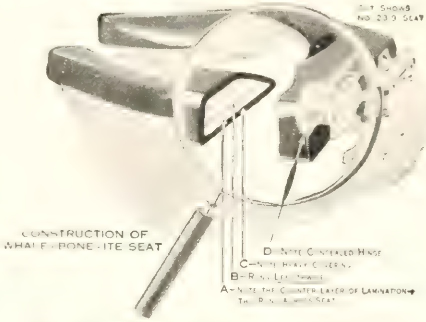
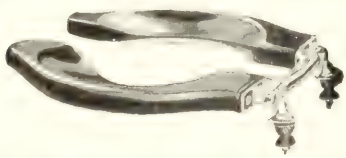
CLOSET SEATS

CREATES CONFIDENCE IN THE USER



No. 23-9—Open front for regular bowls.

No. 21-9—Open front for extended lip bowls.



No. 18-59—Open front and back for extended lip bowls.
No. 18½-59—Open front and back for regular bowls.

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Quality—Durability

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Toilet Seats

Impervious—acid proof.
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Easiest cleaned and no deterioration.

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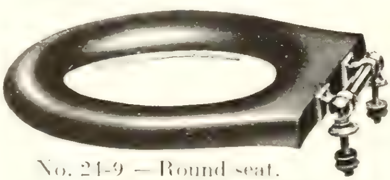

No. 24-9—Round seat.
No. 24-91—Round seat with cover.

No. 16-91—Saddle seat and cover.
No. 16-9—Saddle seat only.

COLORS: Ebony and Mahogany, which immediately shows dirt, dust, etc.

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which the waste and supply fixtures are to come should be shown and a paneled door of proper size provided so that the fittings can be properly installed and accessible in case of repairs. When recess tubs are used—it is always desirable to tile around the top of tub, as this makes a more permanent installation than a finish of hard plaster.

Shower stalls should never be less than 3′-0″ x 3′-0″ inside for a comfortable stall. 3′-2″ x 3′-2″ is the standard size adopted by plumbing manufacturers and should be used wherever possible. Stalls should be at least 6′-6″ high. Solid porcelain receptors, grooved to receive marble partitions are the best and are absolutely leakproof. If marble floor slabs are used they must not be less than 2″ thick and should be grooved all around to receive marble partitions.

The placing of sheet lead flashing underneath marble shower slab or tile for shower stalls on upper floors has been discontinued as it proved to be a useless expense. Very often the weight of the stall above same cracked the sheet lead so that the installation of same as a means to prevent leaks—was a useless expense.

The best material to use for water proofing under marble or tile shower slabs is to build up three or four thicknesses of genuine asphalted felt well lapped and swabbed with asphaltum and the edges of the felt turned up at least 6″ high at side walls. This is an inexpensive method and far more satisfactory than sheet lead.

It is desirable to place the controlling valves to shower head on one side of the stall near the entrance (see adjoining illustration), so as to permit the water being turned on and tempered without wetting the bather. When a stop valve is placed in the supply to the shower head, it will be necessary to provide the hot and cold water supplies with check valves to prevent the bypass of water from either side in event that the valves on inlet of shower are not entirely closed. When there is no valve between the inlet valves and the shower head, check valves are not absolutely necessary.

All shower heads should be placed 6 feet above floor for adults and 5′ 6″ for school showers provided with an adjustable ball joint by means of which the angle of the shower head may be changed as desired. Shower heads arranged in this manner give better results and will not wet the bather's head unless he so desires.

When thermostatic or anti-scalding shower valves are used, it is always desirable to place on the hot and cold water supply line for each, a loose key compression shut off by means of which the supply can be controlled, which is necessary if the pressure is very high or the pressures of hot and cold water are not equal.

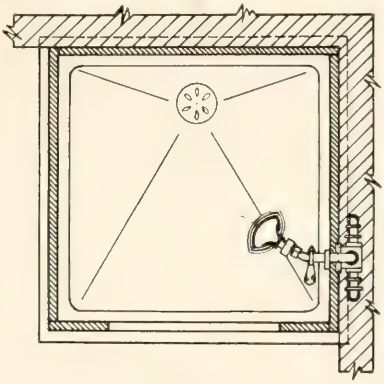
When plain compression type control valves for showers are used in place of thermostatic or anti-scalding valves—a thermostatic hot water control valve should be placed on the hot water supply line to the showers and set so as to prevent the hot water exceeding 110° F. in temperature.

The placing of plumbing fixtures against outside walls should be avoided. It is very unsatisfactory. Even if the supplies are carefully covered there is always danger of freezing. The custom of placing bath tubs under outside windows is most objectionable. This has been commonly done in apartment house work. A little study of grouping would have produced better results.

In public toilet rooms the arrangement of water closet stalls must be well considered. Where a number of these are to be installed the size of the stalls must be determined. The adopted standard width is 2′-6″ centers for schools—they should not be less—but may be more. For adults the stalls should be 2′-10″. Three (3) feet is the greatest width that should be used. To make them wider would be waste of space. The depth inside should not be less than 4′-6″ with doors swinging in. This depth will allow the standard width—2 foot door to well clear the front of the closet bowl.

In factory, etc., and school work, especially primary grades, it is better to omit doors entirely and in this case the stalls need not be more than 3 feet, or at the most 3′-6″ in depth.

If possible all flush tanks, piping, etc., should be concealed in a work space in rear of closet stalls. The wall of work space being formed by the backs of partitions or a built up wall as desired. Frequently this same work space is also utilized as a vent space, providing the back of each stall with a vent opening, protected by a ventilating hood or register face. This makes a most



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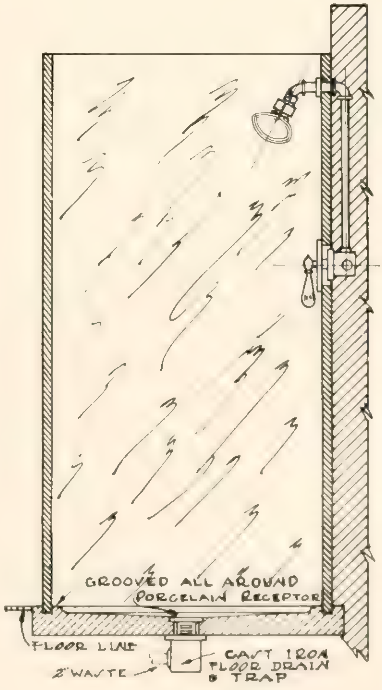


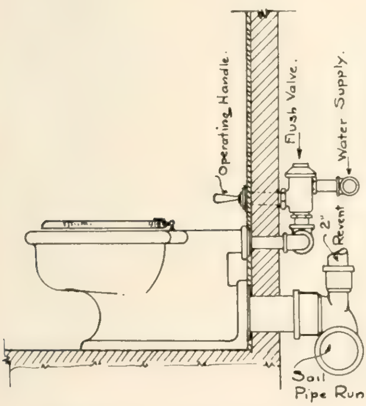
SECTION

desirable arrangement for ventilating large toilet rooms—especially adapted for schools, asylums and all public toilet rooms.

The water closet stalls may be of marble, slate or steel according to the class of work. Steel partitions are very satisfactory and excellent for school and factory work.

The bottom of all partitions should be 12 inches above the floor. When marble is used the pilasters should be 1½ or 2 inches thick and grooved to receive the partitions. The backs should be cut out to receive the partitions and a top rail of marble corresponding in thickness to the pilasters and 3½ or 4" high extend along the entire front. The bottom of rail should not be less than 6'-6" high for schools and 7 feet for public toilet rooms. This arrangement does away entirely with brass floor and top standards and all metal angles—very desirable for the reason that nickel plated brass work becomes tarnished very quickly and is rarely given the care it requires to keep the same in good condition.

If wood doors are used they should preferably be of the type known as "sanitary", perfectly flush without panels. The standard size is 2 feet wide, 5 feet high and 1⅛" thick. They should be provided with an adjustable N. P. box spring hinge and blank with check, door latches and stops and should always swing in, with spring set to hold the door open when not in use.



WATER CLOSET- WALL OUTLET.

While on the subject of water closet stalls a word of caution regarding the floor is apropos. It frequently happens, especially in school and factory work, that the floors of toilet rooms are pitched toward a floor drain and whenever this is done the contractor doing the flooring work should be cautioned to keep that portion of the floor on which the water closets are to set perfectly level and establish his break line at least 3 inches forward of the front of the base of the water closet bowls. Unless this is done the plumber when setting the bowls will level them up with cement in order to obtain an even bearing and the cement under the base of the bowls either causes them to crack on account of unequal expansion and contraction or because of improper support throughout the entire base, the unequal strain on the ware will cause cracks.

For connecting water closets to soil pipe or fittings only cast iron bends of an approved type should be used—with a gasket of asbestos, graphited.

Now as to the type of water closets to be used. There are today practically only two styles—one known as a siphon jet bowl, the other a washdown with jet. There are of course a large number of various special type bowls in the market but they are modifications of the above types.

The siphon jet bowl is the best to use on account of its more quiet action in flushing and also for the reason that the interior of the bowl presents less fouling surface, owing to the larger water surface.

The greater the cross-sectional area of the siphon limb the better the operation of the bowl. The minimum diameter of the siphon limb should be 2½" and 3" is better. The more uniform the passage is the less danger of stoppage. All bowls should be tested out under water before shipment by the manufacturer—for two reasons: one to determine whether the ware is free from cracks—called "dunts" by the potteries, the other to be certain that the construction of the bowl is perfect.

In many localities the water contains incrusting ingredients that may cause clogging up of the jet tubes in time. Such conditions may be remedied by emptying the water contained in the bowl and pouring a pint or more of "Commercial" Muriatic acid into the bowl. The acid will dissolve the solids in the jet opening in about ½ to ¾ of an hour.

However, where the water is extremely bad—it is advisable to use the washdown type of bowl with jet, which is not as apt to become stopped up as the jet openings are larger than in the siphon jet type and the tube has no pocket in which deposits can accumulate.

Where it is necessary to practice economy in the selection of fixtures—it is advisable to use washdown water closets with jets. For Schools and Factories this style is generally used.

There is another type of closet used today which is a composite of the siphon jet and washdown bowls. This bowl is known as the "reversed trap type" and when correctly designed and properly made, makes a very satisfactory closet. It has less fouling surface than the washdown bowl and is siphonic in action.

The conditions that are to be met in each case must necessarily determine the particular kind of closet that should be used. Also whether the bowls should have extended lips, floor or wall outlets, have low down tank, or flush valves or flushed automatically by seat operating valves. No fixed rule may be prescribed for such selection, which can only be made according to requirements of the work itself.

In the selection of water closets consideration must be given as to the manner in which the closets are to be flushed. Water closets with high tanks or low down tanks require a ½" supply connection, whereas these fixtures if operated by means of flush valves—require 1 to 1¼" supply connections to each flush valve. Water closets with automatic seat operating valves require ½" supply connections as a rule.

Where there is more than one water closet in a row or battery, the main supplies for such battery must be of a size that will adequately supply all fixtures. Reference to the following table will be of service.

Table of Branch Supplies for Water Closets.

The following table will be of service to determine the proper size of branch supplies for water closets from 1 to 12 fixtures in a battery. The size of pipe is based on a pressure of from 20 to 40 pounds.

The above illustrations represent a few of our many designs of Bath Room Trimmings finished in Porcelain Enamel on a special metal base; Medicine Cabinets, Mirrors and Hardware in the same finish. A phone call will bring our representative to your office with samples.

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For Automatic Seat Operating Water Closets or Water Closets with Low-Down or High Tanks. Inlets ½".

Number of Closets	Size of Branch, Inches
1	¾
2	¾
3	1
4	1
5	1¼
6	1¼
7	1½
8	1½
9	1½
10	1½
11	2
12	2

Each branch connection to closet valve or tank shall be ½ inch.

For Water Closets with Flush Valves Having 1¼" Inlets.

Number of Closets	Size of Branch, Inches
1	1¼
2	1½
3	2
4	2½
5	2½
6	2½
7	2½
8	2½
9	3
10	3
11	3
12	3

Each branch connection to flush valve shall be 1¼ or 1 inch, according to style of valve used.

Refer to table of "Delivering Capacities of Pipes" on Page 499 for sizes of branches where inlets are other than ½" or 1¼".

The water pressure must also be carefully considered for flush valves and automatic seat operating valve closets. For the former the minimum should be 10 lbs., and for the latter 20 lbs., at each bowl.

Consumption of water is another item to be considered. Tank closets will use 6 to 8 gallons per flush: those with flush valves from 8 to 10 gallons according to the pressure and automatic seat operating closets will only use 2½ to 3 gallons per flush.

Now regarding urinals—At present there are four types. The solid porcelain urinal 18 and 24" wide which sets into floor and has a lipped extension base the top of which is usually set flush with floor. Then there is the old style wall hung urinals—either wash-down or siphon jet type. The enameled trough urinal and the slate or marble ventilated stall urinal with porcelain trough gutter set in the floor.

The first type mentioned is the one most generally used except for factory and school work. For the latter work the slate or ventilated stall urinal has several features in its favor. It is less expensive than the solid porcelain urinal and when equipped with a proper flushing device and a deep porcelain gutter carrying not less than 2" of water which is automatically flushed out periodically, makes a most sanitary fixture. The urinal is the most objectionable of all plumbing fixtures and unless it is properly ventilated and gutters contain a sufficient quantity of water for proper dilution of the urine, the fixture becomes a nuisance.

The Chicago ordinance does not permit of a urinal with gutters in the floor and I believe this a serious oversight. It permits of the use only of the solid porcelain, wall hung or lipped trough urinals. The two latter types are unquestionably inferior from a sanitary standpoint to a slate or marble ventilated urinal with a solid porcelain gutter and siphon trap.

When setting solid porcelain urinals into the floor a depth of 4" is required to bring the top of the drip receptor flush with the finished floor. Care should be taken to set these in accordance with instructions of the manufacturers. They must never be solidly set in a cement grout; an inch or more of dry sand should be put under same and a strip of expansion joint composition placed on the front edge and exposed sides so the concrete sub-base of floor will not adhere. The finished tile, terrazzo or cement may be run up against the porcelain ware.

Regarding the other fixtures such as lavatories, sinks, slop sinks, etc., space will not permit going into details. The catalogues of manufacturers generally give all information necessary regarding same.

The only question of material interest to the Architect regarding these is the kind to be used. This in a measure may be determined by the class of the work itself.

For lavatories for first class work—only those of the best vitreous ware should be used. These are made in many styles and sizes. Enameled iron lavatories are not as desirable as those of vitreous ware.

For sinks—there are a large variety—solid porcelain, vitreous in certain sizes, enameled iron; slate, alberene stone and copper. "Liberty" silver and galvanized steel. Each has its especial field and the kind and size must be determined for each class of work.

Brass Goods:

In order that the Architect may be assured of obtaining durable material great care should be used in the selection of the brass goods which include faucets, bibbs, stops, and supply piping for lavatories, bath tubs, showers, sinks, etc.

For first class work the following clause should be inserted in the specification.

"All brass work shall be red metal brass of a composition in accordance with the Navy Department standard—which is 85% copper, 5% tin, 5% zinc and 5% lead. All tubing such as flush pipes, etc., shall not be less than No. 14 gauge and all supply pipes shall be full iron pipe size, annealed, red brass. All nickel plated work shall be of the highest quality and subjected to the nickeling process for a period of not less than one hour. All faucets, valves and bibbs shall be provided with stems having movable loose discs. Discs to be of special hard fibre and not so called composition and all discs must have edges encased by a brass protecting rim.

"For all concealed valves or stops the operating part must be removable from face of wall and the discs the same as above and the seats of removable, renewable, type."

Cost today, more than ever, is an important factor in considering the quality of plumbing fixtures that should be used. However, it would be very poor judgment to sacrifice quality of material in any line on account of cost. The work of the Architect is not for today, but for tomorrow, and he who builds well in all things will profit more than one who builds poorly, and hence, now more than ever skill in design and knowledge of materials and their proper use will be required of the Architect to secure results.

Nothing will cause as much annoyance and require as constant repairs as a poorly designed and cheap installation of plumbing. Repair bills are a constant reminder to the owner of mistakes made by the Architect, who failed to give in full the service for which he was paid

ULTRA VIOLET RAYS FOR STERILIZATION OF WATER

It has long been known that light has bacericidal properties and a paper given in 1877 before the Royal Society of London by Downes & Blunt called attention to the fact that direct and even diffused sunlight has the power of killing the bacteria of putrefaction. It was shown that the most active rays were the blue, violet and ultra violet frequencies and that heat rays played no part in this action.

In 1892 Professor Marshall Ward with Sir Oliver Lodge conducted tests using the electric arc and exposed culture plates to the ultra violet energy as well as to the energy of other parts of the spectrum and showed conclusively that the ultra violet produced powerful bactericidal action.

It was not until 1910, however, that elaborate experiments conducted at Sorbonne University, Paris, by Henri, Helbronner & Von Recklinghausen led to the development of an apparatus for the use of ultra violet rays in the treatment of water. These experiments resulted in the first commercial use of this process of water treatment and in 1912, the first commercial installation was made in this country. Since that time the apparatus has been developed and improved so that today it is being used with distinct success on drinking water supplies, bottling plants and swimming pools and in fact is suitable for any use where a water is desired that is free from pathogenic or disease producing bacteria. In its present state of development it is capable of taking care of capacities up to 150,000 gallons per hour.

All light is vibration and lights of different colors have different wave lengths or intensities of vibration. The white light of the sunlight is composed of lights of many colors each of different wave length, as seen in the rainbow or spectrum. These colors range from red, which has the longest wave length of the visible colors, through orange, yellow, green, blue to violet which has the shortest wave length of the visible colors. Beyond the visible red are rays called infrared, which are invisible and of greater wave length than the visible red. These are heat giving rays and do not have power of bactericidal action. Beyond the visible violet lie the invisible Ultra Violet Rays which are of extremely short wave length and most intense in their vibrations. To the rays of the Ultra Violet frequency is due the bactericidal action which is utilized in the treatment of water as well as used extensively in therapeutic work. The light rays richest in the production of ultra violet are those having a wave length of about 1849 anstrom units (one anstrom unit equals one ten millionth of one centimeter). It is to these rays in the sunlight that its purifying power is due.

The rays of the ultra violet frequency are amazingly destructive to germ life though the exact action responsible for these results is not known. An investigation conducted by Prof. W. E. Burge at the University of Illinois presented evidence that ultra violet radiation killed living cells by coagulating their protoplasm. Other theories also have been advanced but nothing definite as to the exact action has been determined except that the pathogenic bacteria are almost instantly killed upon exposure to ultra violet radiation and if not instantly killed are so inhibited that their powers of reproduction are removed.

The sun is the great source of ultra violet radiation. In rarified atmospheres this is particularly noted but due to the atmosphere surrounding the earth a great deal of it is filtered out before reaching the earth's surface. Small amounts of ultra violet are produced by practically all artificial light sources but at the present time the most successful method of producing these rays in intensity sufficient to be utilized commercially is by means of the mercury vapor quartz lamp.

The mercury vapor quartz lamp consists essentially of an arc produced across mercury vapor in a vacuum enclosed in a quartz tube. (Illustration). The lamp has a straight quartz tube with a bowl at one end partially filled with mercury. The straight end of the lamp is the positive or anode connection while the bowl end is the cathode or negative connection. Mercury is a conductor and when the two ends of the lamp are connected in an electric circuit and a mercury bridge formed from the positive to negative connection electricity flows through the mercury. To produce the Ultra Violet Rays it is necessary to form an arc in the vacuum which is done by slightly raising the straight or positive end of the lamp either automatically or by hand, thus breaking the mercury bridge and producing a short mercury vapor arc. As the arc heats up it gradually vaporizes some of the mercury and forces the balance up into the bowl until in a few minutes no mercury is left in the stem. The mercury vapor arc then extends the whole length of the tube and Ultra Violet Rays of great intensity are produced.

The lamp for the production of ultra violet radiation must necessarily be made of quartz (fused rock crystal) as this is the only known solid substance except ice through which ultra violet rays will pass without losing their intensity. Glass which is transparent for visible light is opaque to ultra violet and while the standard mercury lamp used for illumination will produce ultra violet radiation still none of the rays are radiated due to the lamp being made of

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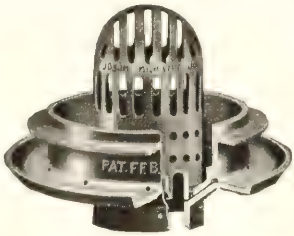
"DOUBLE DRAINAGE" PROTECTION



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A drain for any type of building or installation where drains are required.

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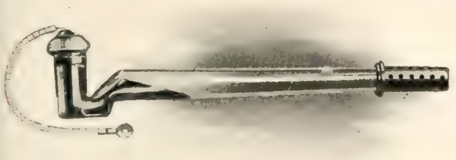
glass. The mercury vapor quartz lamp is particularly rich in the production of ultra violet rays of a length of 1849 anstrom units (.0001849 centimeter) which have been shown to have extremely high bactericidal power.

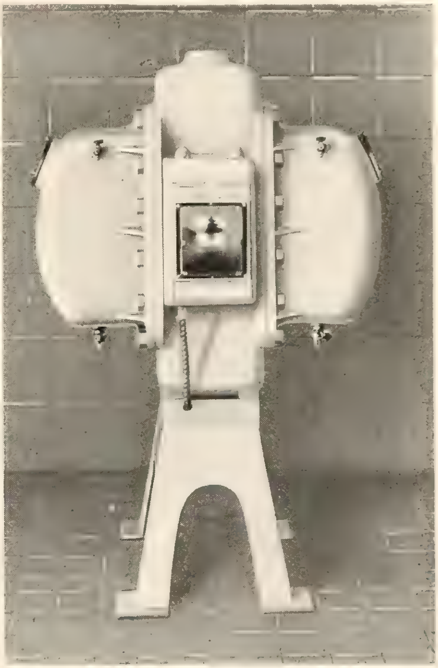
Though Ultra Violet Rays will exterminate germ life through a considerable distance naturally the nearer the bacteria are brought to the source of the rays the shorter the period required for extermination. In the types of apparatus using the Ultra Violet Ray for water treatment the construction is so arranged that not only is all of the water passing through the apparatus forced to flow near the lamp in a thin film, but it is continuously exposed to the rays and is also continuously stirred or turned over so that all surfaces of bacteria are exposed to the rays. The apparatus briefly consists of a mercury vapor quartz lamp set in a water compartment so arranged that the water, always exposed to the rays, passes around or near the lamp in a thin film.



One type of the Ultra Violet Ray Water Sterilizer is illustrated. This is a pressure type apparatus and may be used in any supply line with pressures up to 75 lbs. per square inch. These units may be used separately or connected together in series depending upon the capacities desired, the water passing through each unit successively and being exposed to ultra violet radiation in each unit. For capacities of from 10,000 gallons per hour up, a pressure type a little different in construction is made which is so arranged that as many as eighteen lamps may be connected together in series. A gravity type is also made primarily for use on swimming pools where it may be faced with tile to harmonize with the surroundings and give an artistic effect to the pool room. This type is not suitable for capacities over 8,000-10,000 gallons per hour on account of the gravity flow.

In all types the mercury vapor quartz lamp is suspended through the center of the apparatus and is kept from direct contact with the water by a protecting quartz tube which is fixed in the body casting and packed against external water pressure. Baffles are so arranged that the water is directed around the quartz tube and agitated so as to expose all surfaces of bacteria to the rays. Suitable tilting mechanism for starting the lamp as well as the necessary apparatus for controlling the electrical supply is furnished complete with each unit.

The mercury vapor quartz lamp used in the water sterilizer apparatus operates only on 220 volt Direct Current and where this is not available at the installation site a motor generator set is used to deliver the necessary 220 volt Direct Current from whatever current is available. The operating characteristic of the lamp at efficiency is 160 volts at 3½ amperes, the balance of the incoming 220 volts being taken up in ballast resistance. The current consumption of each lamp used is therefore .77 K. W. per hour.



The Ultra Violet Ray process has a distinct feature in water treatment in that elimination of the bacteria is accomplished without adding any substance to the water or changing its character in any way. Sterilization is accomplished simply by passing the water through a field permeated by ultra violet radiation and bacterial elimination results from exposure to the rays. If the water is passed through within the rated capacity of the apparatus complete pathogenic bacterial elimination is accomplished regardless of the extent of the contamination in the raw water. Thus the unreliable human element with the uncertainty of the proper regulation for the correct amount of dosage of the sterilizing agent is entirely removed from the process.

On swimming pools the ultra violet ray process has a distinct field as the apparatus is installed on the circulating line at some point between the filter and the inlets to the pool so that all of the water on every recirculation is forced to pass through the sterilizer and is delivered to the pool free

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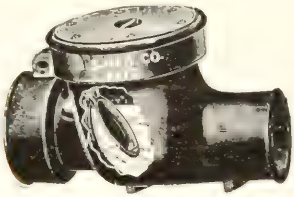
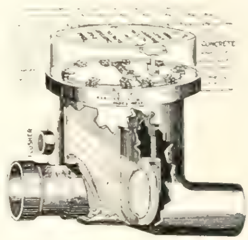
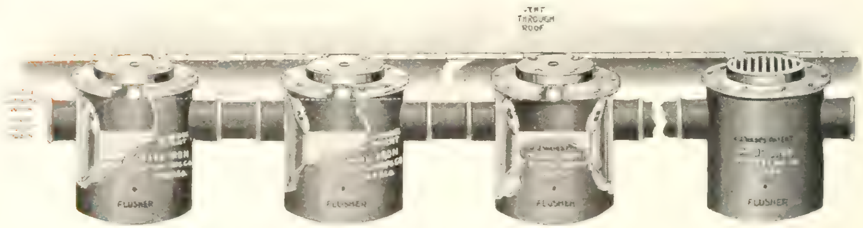


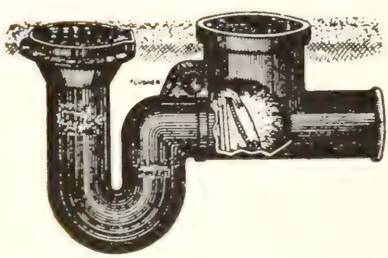
B-Fig. 1.
Wade Accessible flushing backwater valve for prevention of flooded cellars.



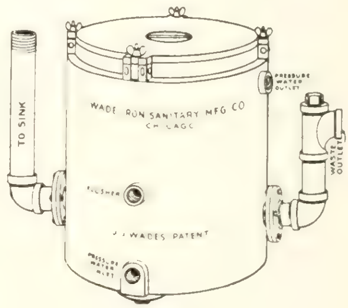
B-Fig. 6½.
Automatic and hand shut-off back-water valve combination.



B-Fig. 37. Oil separator for garages.
B-Fig. 37½. Floor drain basin.



B-Fig. 18.
Floor drain and backwater valve.



B-Fig. 27.
Water jacket grease basin.

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from all bacterial contamination. Given proper distribution and turnover it has been possible for pools equipped with the ultra violet ray sterilizer to operate for long periods of time without completely emptying and refilling the pool with fresh water while bacteriological analyses have shown the water to be free from pathogenic bacteria and of the highest standard of purity. Such results show great savings in operating costs due to the saving on water and heat while the operator has the added assurance that the health of the patrons is safeguarded to the best of his ability. W. F. Walker (Department of Health—Detroit) states in the April, 1922, issue of American Journal of Public Health "Sterilization by ultra violet rays of swimming pool water in a recirculation system properly designed and operated gives a water which compares favorably with the government standard for drinking water."

The use of ultra violet rays is ideal for the treatment of drinking water supplies as well as water for bottling plants as the water is automatically treated and delivered from the sterilizer outlet free from any disease producing bacteria and still retaining its original body and snap without any change in the taste or chemical composition. Investigations of record show that the ultra Violet Ray process when properly applied eliminates the dangers of aftergrowths in the water treated which is so commonly found in waters treated by chemicals, particularly where the chemical dose has been too small for the amount of contamination and organic matter in the water. It is particularly noted that even the hardy spore forming bacteria are killed by exposure to ultra violet rays. This feature of the ultra violet ray process is particularly advantageous to the operator as the human element with its uncertainty, forgetfulness, error in judgment and often lack of skilled knowledge is entirely eliminated from the process. As nothing is added to the water no objectionable tastes or odors can be imparted. No mixing is required which can cause poor results due to insufficient contact with the bacteria. The process is automatic in its action and when operated within its capacity on a water free from sediment visible to the naked eye will produce positive results.

After repeated tests by the United States Public Health Service methods of water treatment the Ultra Violet Ray process was approved for use on the drinking water supplies on boats operating on the Great Lakes. These installations are very carefully watched by the Public Health Service and every boat must show a water conforming at all times to the standards of bacteriological purity as adopted by the U. S. Treasury Department. The fact that the Ultra Violet Ray process is in use on the majority of large passenger boats operating on the Great Lakes and continually under the strict supervision of the U. S. Public Health Service indicates the efficiency of the process.

For bottling plants the Ultra Violet Ray Sterilizer may be installed directly on the main water supply line, insuring to the bottler that all of the water used in the plan, whether product water or water used for the final rinse of the bottles, is free from any disease producing bacteria that might contaminate his product and result in a loss of revenue or possible claims due to sickness resulting from the impure product. Many prominent bottlers are using this process with distinct success.

The Ultra Violet Ray Process for sterilization of water is in its infancy but the many successful installations on municipal water supplies, private water supplies, swimming pools and bottling plants show its worth and the positive results obtained with the automatic action and ease of application should recommend it to anyone interested in the supplying of a water free from any disease producing contamination.

PLUMBING DESIGN IN TALL BUILDINGS

By THOMAS J. CLAFFEY

The tendency in the erection of modern hotels and office buildings is to increase the height. As the height of a building exceeds 8 to 10 stories, the effect upon water supply, plumbing and ventilation systems is immediately noticeable. In plumbing systems, the effect is noticed in the agitation of water in closet bowls and traps of other fixtures. When the height of buildings reach and even exceed 16 stories, the effect upon traps and plumbing fixtures becomes such that engineers and plumbers are forced to recognize the fact that something is wrong with the practice of installing plumbing systems. Little attention has been given the enormous striking force exerted by a column of water falling from the height of approximately 200 feet in a vertical pipe. The air compression in a plumbing system under such circumstances becomes so severe that the ordinary system of vents and revents as provided for in our present plumbing ordinance, seems inadequate.

There have been numerous examples of extreme air compression brought to the attention of the writer, brief reference to two of which will give some idea of what this means to the designing architect or engineer, as well as to the owner of a building.

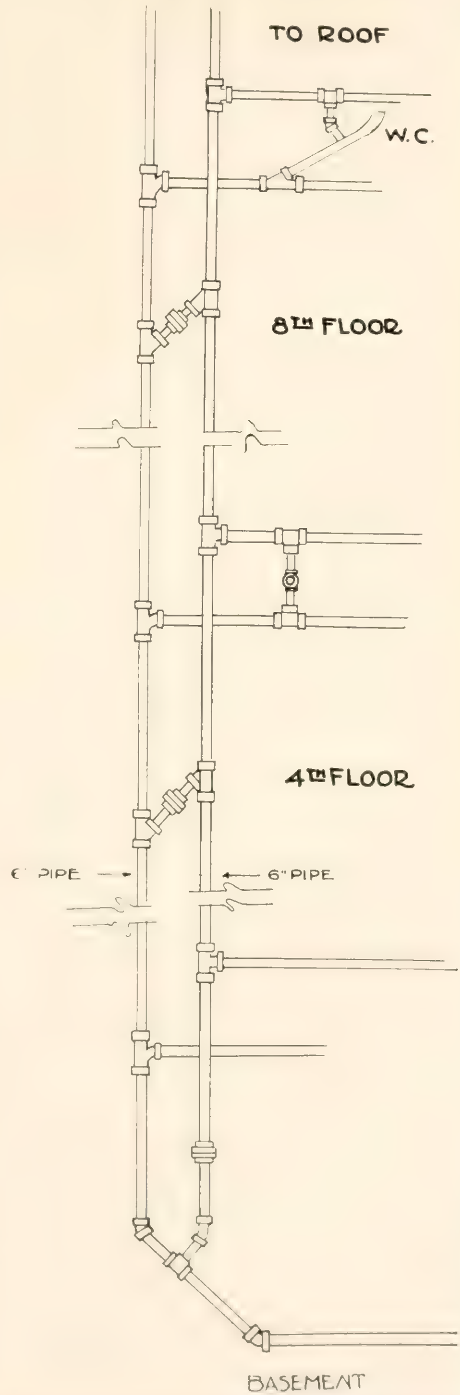
One of the first of these was an 18-story office building in which the main toilet rooms were on the top floor. A 6″ soil pipe carried off the waste and was extended through the roof, full size. A 3″ vent pipe was connected into the bottom of this line, and extended through the roof where it was increased to 4″. The revents for each individual fixture were connected to this vent pipe. In spite of all this, during periods of heavy operation of the main toilet room, the fixture seals were broken and water blown out of water closets and other fixtures onto the floors below the top floor. It became necessary to install an extra 4″ relief vent pipe to take off the excess air pressure near the bottom of the line.

Another example was in a 10-story loft building in which the soil and vent pipes were installed according to the ordinance and similar in many respects to the installation just described. With the first heavy rain, and before the building was occupied, water was blown from the closet on the first floor almost half way to the ceiling. It became necessary immediately to provide relief, and the building being of concrete construction, the difficulty of cutting floors and extending a pipe through the roof seemed insurmountable. It was found possible, however, to obtain a connection near the outlet at the curb wall which discharged into a large receiving tank having an overflow to the street sewer. The necessary safety valve was provided, but it was a job that even the designing engineer was not proud of.

It is evident that the ordinary plumbing ordinance does not meet the requirements of the exaggerated conditions experienced in tall buildings. Plumbing ordinances specifying vent sizes, etc., were drawn in days when this type of building was in its infancy. We now see the necessity for revising some of the requirements specified in ordinances. It is not, however, a revision downward as many would think, but in the other direction. We know from experience and from tests,* that vent pipe sizes should be increased over those specified in our present plumbing ordinance. We are convinced that the main vent pipe should be at least as large as the soil or waste pipe which it serves and preferably a little larger, that it should be cross connected full size at intervals as shown in Figure (—), and should be connected in a specific manner at the bottom of the line. The latter is far more important than appears at first glance. From tests that were made at the University of Illinois, it was clearly demonstrated that the efficiency of a plumbing vent system depends largely on how this connection at the base is made. Unless provision is made to effectually separate the air and water at this point, there will be a seething mass of compressed air and water churned up in such a manner as to fill both soil and vent pipes and to prevent the passage of impounded air. By connecting in the manner shown in illustration, the falling water strikes the lower side of the fitting, and connecting nipple *a* to the horizontal extension, and follows the wall of the pipe. The air is released and escapes along the upper wall of the pipe *b* and up through the free opening of the vent *c*. This provides for the free escape of impounded air at the base of a vertical line of pipe and full sized cross connections at intervals above relieve pressure within the system by permitting a free circulation at much lower speed than is obtained otherwise.

The additional cost of these suggested improvements when compared with the total cost of the system are infinitesimal. We are sure that experience will demonstrate the justification for such expenditure.

There is no dependable data on proportioning pipe sizes of soil and vent pipes. Roughly speaking, a vertical pipe will carry off the discharge from any horizontal branch line, either singly or on separate floors. Therefore, the horizontal soil or waste pipe carrying the largest number of fixtures determines size for the vertical to which it connects. Main vent pipes as previously mentioned, should be as large as the vertical soil or waste pipe which they serve and a size larger in buildings exceeding 16 stories high.



*Note—See report of tests at University of Illinois. Page 66, Proceedings 1916—A. S. S. E.

PIPE SIZES IN STANDARD PLUMBING SYSTEMS

In a previous issue of the "Hand Book for Architects and Builders" reference was made to the carrying capacity of vertical and horizontal lines carrying the discharge from fixtures, and it seems opportune at this time to continue that a little further.

The assertion made at that time was that generally speaking a vertical pipe will carry all the waste water discharged into it from various branch lines if such vertical pipe is as large as the largest branch connected to it. In all of the twenty-five years experience we have had in connection with the installation of plumbing in all sorts of buildings in Chicago, there has never been one instance which would tend to disprove this theory or assertion.

Generally speaking, engineering data on this subject is not a safe guide to use in proportioning pipe sizes, for the reason that such tables are based on the use of pipes for entirely different purposes. In an article in the January 15th issue of the "Plumbers Trade Journal, Steam and Hot Water Fitters Review" of this year, by Mr. J. J. Cosgrove, one of the foremost sanitary engineers in connection with plumbing and drainage, he discusses the use of a 3″ soil pipe and incidentally the carrying capacity of pipes. He mentions changes which have been made in plumbing practices in New York City in the last couple of years and says further "The greatest improvement of 1921, to my mind, was the adoption of a 3″ soil pipe connection for water closets instead of the 4″ pipe required heretofore." In the course of his remarks he says that 8 gallons is the normal discharge from a water closet and that this quantity of water is no dumped in one deluging mass but poured in a continuous stream, which breaks the flood of water, so to speak, and lengthens the time of discharging such a quantity of water. He estimates the discharge to be approximately 7½ gallons per second. We believe this is an error and if he said 7½ gallons per minute he would be closer to the true facts. Quoting him further, "a 3″ drain laid at a grade of 1 to 20 and run through without head will have a velocity of 35′ per minute and discharge 100 gallons of water in that period of time. That is at the rate of 1.66 gallons per second, which is about the discharge from two closets, but three conditions enter into the problem here. In the first place closets are spaced from 3 to 4 ft. apart so that if they are all flushed simultaneously an interval of time would pass before the water from the second closet would mix with that from the first, the water from the third closet with that of the second and so on. It would require a combination very nicely timed to cause the water from a battery of closets to meet at any exact instant. But estimating it to the moment the horizontal pipe filled and the head began to pile up the hydraulic head would be converted into a velocity head and the flow of the water would be double or more than double. It becomes one of those many paradoxes, that the more you pour into a pipe the more it can and will take care of, this, of course, within reasonable bounds."

It is a well known fact that water does not flow in a branch soil or waste pipe as in an ordinary drain, for the reason that the head of water is not a constant. The discharge from sinks and lavatories is a fairly constant head but that from water closets varies in that respect by reason of the driving force in the flush and this varies as the types of flushing arangements vary. Assuming a head of water of 2′ in an ordinary 4″ branch soil pipe and a flush of four gallons per water closet, with a length of 50′, such pipe would have a capacity of discharge of approximately 30 gallons per minute. These calculations are based on a standard engineering table of the capacities of pipes under given heads, diameters and length of pipe, etc. Allowing a space of 3′ center to center for each closet, this would permit an installation of approximately 16 water closets on a 50′ branch; with a combined capacity of 64 gallons discharge, asuming 4 gallons to the flush, this would be double the theoretical capacity of such pipe. On first glance it would seem that a 2′ head on such pipe would be a reasonable one to assume. That might be true if it were not for the fact that we have a velocity head to think about as well as a static head and the velocity head is the real controlling factor in such a problem.

In interviewing several of the most experienced and well established plumbing contractors on this subject we have developed the following:

Installations

1st—28 water closets on a 4″ branch line.

2nd—20 water closets on a 4″ branch line.

3rd—32 water closets on a 4″ branch line.

Each and every one of these installations has proven satisfactory and has operated without any trouble from air compression or otherwise. This to me is sufficient evidence that a 4″ horizontal soil pipe has a greater carrying capacity than has been commonly believed possible.

In the proportioning of vertical pipe sizes there is no doubt that we can with perfect safety adopt the general rule that the largest branch line should determine the size of such pipe. The only question which might arise would be the handling of air currents set up by reason of a large volume of water falling from a height. A common practice in this respect and one which I think unfortunate is a tendency on the part of many designers to make the vent pipe a size smaller than the soil or waste pipe which it serves. Experience and experiments which have been conducted seem to give positive evidence that the vent pipe should be at least as large as the soil or waste pipe which it serves and in very high buildings somewhat larger. In this connection it is just as important that the connection at the base line of these two vertical pipes should be made in the proper manner, and this too is a point almost entirely overlooked in plumbing practice. It is probably safe to say that over 95% of the troubles developed in a plumbing system, by reason of air compression, is due to the manner in which the main vent pipe is connected to the main soil or waste pipe at or near its base line. A suggestion for such a connection has been shown in the 1921 issue of this "Hand Book." The suggestions contained therein are based on practices which have been proven by experience to be right, and for that reason we feel safe in recommending them for consideration.

Aug. 1922.

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VARNISHES, STAINS AND FILLERS,

By R. W. LINDSAY, CHEMIST

Only a few decades ago varnish making bordered on an occult art. The formulas and rule-of-thumb methods used by different manufacturers were so zealously guarded that the interest of others did not reach back of the finished product. Then the chemist entered the field. He made an exhaustive study of the properties given to varnish and its allied products by the different materials entering into their manufacture. Thus equipped, he was able to make products exactly adapted to all of the increasing number of purposes for which finishing materials are used. This means that to-day the architect can find excellent materials for any finish that he may wish to secure; but this bewildering variety of materials also means that he must give more thought than ever before to his selection. Should I specify an acid stain or an oil stain? Why should I use varnish instead of shellac on floors? These are samples of the hundreds of questions that can be answered intelligently only when the solution is based upon a comprehensive, organized knowledge of the materials available. And for the one who will delve deeply enough, it is a study as fascinating as it is profitable.

In considering the above subject it will be necessary to divide this treatise into four distinct classes in accordance with the title.

Stains.

The subject of stains may be divided into four parts, as follows:

1st..........Aniline Oil Stains
2nd..........Aniline Spirit Stains
3rd..........Pigment Oil Stains
4th..........Acid Stains

By the aniline oil stain is meant a stain made by the solution of an aniline color in some solvent such as benzol, solvent naptha, turpentine, benzine, or in other words, an oil solvent. Often in combination with these aniline colors is used a considerable amount of asphaltum varnish in order to obtain certain desired results. There has always been, and still is, a great deal of doubt in the minds of most users as to just what is meant by an aniline color and when we consider the great number of organic compounds known as aniline colors, it is not strange that such is the case. By an aniline color we mean one derived from the chemical compound aniline which is found in coal tar. Aniline is then treated with various acids and other chemicals and we are able to form new compounds and from these compounds still other compounds, and it is these various new compounds which are formed that are the aniline colors of commerce. These colors vary in their solubility according to their composition and consequently we have aniline colors soluble in oil, aniline colors soluble in alcohol, aniline colors soluble in water and in addition we have also many aniline colors, which we may say are "forced" in their solubility, i. e., the aniline color may be only slightly soluble in a solvent such as benzol, but when combined with a fatty substance such as stearic or oleic acid, which is soluble in benzol, is carried into solution in this way. This latter fact accounts as you may readily understand for the non-drying nature of many of the oil anilines. The aniline color itself may be a material which would be perfectly dry, but of course, is not permitted to become so on account of the presence of these non-drying fatty acids.

The aniline oil stains have very strong penetrating powers and carry the dye far into the wood. They may be used on both hard and soft woods, both open and closed grains, but naturally better penetration is secured in the softer woods. These stains, being perfectly clear and containing no pigment, produce a beautiful, clear, transparent stain, usually rich in color and beautiful to look upon. This beauty is of course brought out by the application of shellac and varnish.

In finishing a panel with a stain of this nature we find that the stain works very easily, giving a remarkably uniform effect and apparently is an excellent product. Shellac is then applied and later the varnish and the brilliancy of the stain is very much enhanced. Supposing that we have a panel finished up in this way and the same is allowed to be set aside for some time and then later examined, we are very much surprised to find that, first, instead of having a stain rich in color that a great deal of its depth has disappeared and left in many cases, a muddy effect. At any rate the stain has faded very considerably. Secondly we notice that the varnish itself has died down very materially and that upon scratching the varnish film, we have instead of a firm, tough finish, a finish which looks very much as though it were made entirely of rosin. This latter effect is due entirely to what is termed "Bleeding" of the stain due to the following conditions: The stain as applied, was, as stated above, composed of aniline colors soluble in benzol, turpentine and other solvents of a similar nature, and consequently upon application of the shellac over the stain, the alcohol penetrated into the pores and dissolved out a certain part of the stain and carried it into its own film. The varnish, then following, also having the power by means of its thinner, to dissolve this dye, picks up the color and carries it into its own film. These colors are extremely susceptible to this kind of an action and have been known to have carried sometimes through five or six coats of paint. There is one case, which has come to my attention, where there has been applied over a finish of this kind two coats of varnish and five coats of white enamel, yet after each successive coat of enamel has dried, the pinkish cast of the mahogany aniline stain has appeared and cannot be removed unless the entire finish down to the wood is taken off and the color itself removed. Naturally the layman in having his house finished and noticing the condition of his wood finish from time to time, detects the failing of the lustre of his varnish and immediately draws the conclusion that the varnish applied to his house is of an inferior quality and it is my presumption that the reputation of the varnish manufacturer has been harmed a great deal more than we realize by such conditions. Of course, many of the manufacturers of stains of this nature do produce what are called primers, which are supposed to take care of this "Bleeding" effect and no doubt these articles do retard the "Bleeding" very considerably, yet there are none which are absolutely free from this trouble.

In this same class of materials of a somewhat different construction, are the **spirit stains.** These, of course, are made by a solution of aniline colors in alcohol and only used to a very limited extent on account of the fact that they are extremely hard to work and apply evenly, it being almost impossible to apply a stain of this character on a large surface with any degree of evenness, and secondly, they are prone to work

up into the shellac applied over them, so that it is almost an impossibility to get a good finish. They naturally "bleed" very considerably and have caused all kinds of trouble not only in this respect, but also in regard to their fading. Being used in such limited quantities as they are, it is not necessary to describe them further, but merely to state that they should be avoided.

The third type of stain mentioned above is what is termed **pigment stains,** and by such is meant one made by grinding of a pigment or pigments in oil, usually linseed oil, and its subsequent reduction with turpentine or some such vehicle sufficient to effect penetration. The pigments used in stains of this kind are:

Chrome Yellows
Chrome Greens
Carbon Black
Prussian Blue
Para Reds, etc.

and as you can readily see, their staining effects must be really due to the lodgment of the pigment within the pores of the wood. In reality they are nothing but a thin paint sufficiently reduced so as to penetrate the pores of the wood. These stains do not give as clear an effect as the penetrating stains nor do they penetrate the wood so readily, and consequently are limited almost entirely to soft woods where a sufficiently deep penetration may be effected. However, even though these stains are not quite as clear as the previously discussed class of stains, yet they are sufficiently clear to produce some very beautiful effects and when we consider the fact that they are practically non-fading, have absolutely no tendency to "bleed" and that the after results are consequently very much more satisfactory than otherwise, we must concede that they are far superior to any stain in which the after-results are very questionable. Furthermore, these stains being made upon a linseed oil base, have a tendency to preserve the wood and consequently are of material assistance in this way.

The third class of stains mentioned above are the **acid stains.** The term acid, applied to most of these stains is a misnomer on account of the fact that nearly all of these stains of this class are practically neutral in their reactions, i. e., they are not made by the solution of acids in water as the same suggests but are made by the solution of various dyes in water or a medium miscible with water. These stains are perfectly clear solutions and when applied to the work, they work very easily under the brush and may be spread out over large areas with a degree of evenness. Having been applied, and the work finished, they are very permanent as regards fading and have little tendency to "bleed".

The reason for the latter effect is due to the fact that the dye used is a water soluble product and consequently even though the vehicle of the varnish applied over the stain may penetrate into the wood, yet the dye is not picked up and consequently does not "bleed" into the successive coats of varnish. This point may be very readily illustrated by carrying out the following experiment: A panel, for example, is finished at one end with coat of mahogany aniline oil stain and at the other with a coat of mahogany acid stain and a coat of shellac is applied over the entire panel, followed by a coat of white enamel. Allow this panel to stand for a short time and the result is, that within a very short period of time, it will be noticed that the enamel over the aniline oil stain is covered with reddish spots, showing the way in which the "bleeding" has taken place. The enamel over the acid stain has not been affected, thus indicating the "non-bleeding" nature of this stain. These acid stains produce beautiful, clear, transparent effects, are permanent and "non-bleeding" and are really the ideal kind of stain, but like many other materials which are so nearly perfect, they have one defect. This defect is due to the fact that when the water is applied to wood, the grain is caused to raise very materially and it is the sanding down of this grain, which restricts somewhat the use of the acid stain. The acid stain is confined almost entirely to the use of hard woods on account of the fact that the softer woods necessitate a large amount of sanding. The best practice is, of course, to sponge off the wood first, sand and then apply the stain and follow with another light sanding. In this way, the maximum amount of stain is retained in the wood and the effect is not spoiled. Notwithstanding this defect, however, these stains are really the most practical, most lasting and produce the most satisfactory results.

FILLERS.

This class of materials may be divided into two parts:

Liquid Fillers.

Paste Fillers.

When Liquid Fillers were first placed on the market, they were offered as substitutes for shellac and at that time the material sold as such was of far better quality than most of the so called Liquid Fillers of today. Today, most of these goods are composed of nothing more than Gloss Oil, a little Linseed Oil and the cheapest Pigment it is possible to get. All kinds of pigments have been used but the most satisfactory are either asbestine or China Clay on account of the property these pigments have of remaining in suspension. Notwithstanding the fact however, that the general run of Liquid Fillers has deteriorated so much, a few of the best manufacturers are producing goods for this purpose which really have quality. These goods are necessarily made so that they dry very hard and firm, carry sufficient pigment so as to fill the pores to a certain extent and give a surface which is very non-absorbent and over which the varnish may be applied in such a way as to have a good full body and lustre. This class of materials is not recommended for use upon floors or for exterior purposes on acount of its extremely hard nature, yet for certain purposes, it serves in a very favorable way, and may be recommended.

The second type of filler is the PASTE FILLER and by this product we mean one sold in paste form and made by mixing or grinding together of certain pigments, linseed oil and a japan drier. The function of a paste wood filler is to close all the pores of the more or less open grained woods, so that, while the surface becomes non-absorbent, the natural beauty is not obscured, and if the wood is stained, the filler must not dull the transparency of the stain. Therefore, the more translucent the filling material, the more valuable the product. Consequently, while barytes, clay whiting and gypsum are still employed on account of their cheapness, the ideal material for a filler is silex or silica. Silex or silica is really powdered quartz, and is a pigment which is extremely transparent, has considerable "tooth," and consequently makes an ideal pigment for this purpose. A paste filler is generally made by merely mixing the silica and its vehicle, and is received by the consumer in paste form. This is reduced with turpentine, and is then ready for application. A good filler should be dry in twenty-four hours, and then sanded and dusted off, leaving a surface ready for the application of the material following.

Fillers are really materials to which suf-

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ficient attention has not been given, and it behooves the architect to see that he gets the most translucent fillers possible even though the same costs him a little more, this extra expense being do doubt explained very largely by the fact that the pigment used is more expensive. Furthermore, the best grade of fillers always contain a good grade of linseed oil and a good gum Japan, the latter serving to harden up and to make the filler non-absorbent. Here, again, the use of a cheap filler necessarily means the use of a material containing a cheap japan which will have the effect of reducing the durability and stability of the filler. Colored fillers for various modern effects are, of course, made up by incorporating certain colors with the regular paste filler and some very beautiful results may be obtained.

VARNISHES.

This subject should be divided into two parts, as follows:

Spirit Varnishes.

Oil Varnishes.

After the wood has been properly filled, it is customary, both in architectural and industrial work, to apply a coat of spirit varnish. For many years practically no material was used for this purpose but shellac.

Gum shellac, as you are no doubt aware, comes to us very largely from India and is a resin produced by the vite or sting of certain insects on the small twigs of several species of East Indian trees. The resin appears to be formed from the plant sap by the female insect from whose body it exudes, ultimately burying the insect and her eggs and forming a thick excrescence on the twigs. This is collected, macerated with warm water to extract a dye and the residue (Seed Lac) is refined by melting and straining. It is then poured in thin films on wooden cylinders when it hardens and scales off in thin flakes and is then called "shellac."

Bleached shellac is made by passing a stream of chlorine gas into an alkaline solution of shellac. There are on the market a number of grades of shellac, due to the fact that during the melting process, rosin is added to facilitate the melting process. The result is that we have a great many products termed shellac which contain a very large proportion of rosin and many which contain absolutely no gum shellac.

Due to the extremely high cost of shellac there has come upon the market a large number of shellac substitutes and, as with all other varnishes, there are many which can be used with a high degree of satisfaction and many which are absolutely worthless. Most of the better grades of shellac are made by dissolving certain spirit copal gums in alcohol. On the other hand, there are a large number of shellac substitutes which are made on a rosin base or at least contain a large proportion of rosin so as to make a substitute which is satisfactory only from the standpoint of price.

To my mind, one of the most important points in an architect's specification is the question of the character of the spirit varnish which is applied over the filler; for the reason that, just as no house can be built with a foundation of sand, so no finish should be built up with a foundation coat which has no durability, is extremely brittle and has in fact no qualities to recommend it except that of cheapness. An architect in recommending a manufacturer's grade of substitute shellac has, of course, the assurance of the house manufacturing that goods that it will be satisfactory. On the other hand, as an architect specifies "shellac" and does not definitely specify as to the grade of shellac, he cannot be certain as to the results. It might be well to suggest that if an architect desires that shellac be used, he write a specification like that of the Government which compels the use of a shellac containing no rosin nor other adulterants. With the extremely high cost of shellac at the present time, architects will find it well worth their time to consider shellac substitutes made by reputable manufacturers for work where it is not necessary to secure the very highest grade of finish.

We now come to the subject of Oil Varnishes, and in taking up this matter we will discuss the various materials used in varnish making and follow this with a brief description of the process itself.

Varnish has four main constituent parts.

First: The fossil resins, or gums, as they are termed, which give to the varnish its brilliancy and lustre and to a certain degree it durabilty.

Second: The drying oils which render the varnish elastic, durable and to a certain extent affect the lustre.

Third: The metallic driers which are incorporated with the oils to hasten the drying of the varnish film, acting as carriers of oxygen from the air to the drying oil.

Fourth: The volatile solvents which aid in the spreading of the varnish upon the work.

First we shall take up the various raw materials used in making varnish, and describe the source from which these various materials come, and then later, the way in which these materials are used in the actual varnish making process.

The first of the raw materials to be considered are the resins, which are divided into three classes. We first have the fossil resins, which are the exudation of trees which existed thousands of years ago, the sap having flowed from the trees to the ground where it was covered with decayed vegetation, etc., and fossilized. Second, we have the semi-fossil resins, which are the exudation of trees of more recent origin, and third, we have the crop resins, which are gathered directly from the tree, the tree being cut in such a way that the sap will flow and this sap is hardened by oxidation.

Zanzibar Animi is a fossil resin coming to us from Zanzibar on the eastern coast of Africa, and is characterized by the goose skin effect which we find upon the various pieces of gum. The gum is extremely hard, and was formerly used in the manufacture of our best grade of piano varnishes and interior varnishes. It was used in the piano varnishes on account of the fact that it makes an extremely hard varnish, and one which may be readily rubbed and polished. It was used in the spar varnishes on account of the fact that it made a varnish which was very durable. This resin is not used today on account of the fact that it is practically impossible for us to obtain sufficient quantities for use in a practical way.

The next resin is that of the Congo Copal, the term Copal being applied to the gum found upon the west coast of Africa, to differentiate between these and the ones found on the east coast of Africa, of which the Zanzibar is a type. The Congo Copal is very light in color, makes a varnish which dries with a good hard film, and is used in large quantities in high grade varnishes. For this reason it is used in high grade baking varnishes and interior varnishes where color is an essential feature.

The Benguela Copal is very similar to Congo, coming from the same general district on the west coast of Africa, but differs in that the varnishes made from this gum are darker. The Benguela is characterized by the greenish cast which is displayed throughout the various pieces of gum.

The Sierra Leone Copal is one of the most elastic resins known to the varnish maker. For this reason it has been used with wonderful success in the pale coach and car var-

nishes and in spar varnishes, where elasticity is the most essential feature. At the same time it makes a varnish which has a very light color, and for this reason it is also very suitable for pale baking varnishes and also for varnishes where elasticity is a most important factor. This resin comes to us also from the west coast of Africa, coming from the district of Sierra Leone.

The next class of resins is the Kauri, coming to us from an entirely different region —from New Zealand. Kauri is one of the most popular resins in the varnish industry on account of the fact that by it may be made a most durable varnish, and also a varnish which is excellent for rubbing and polishing purposes, due to the fact that when this resin is handled properly varnish may be made which has less tendency to "sweat out" in the process of rubbing than a varnish made with other gums. Furthermore, Kauri has very good durability, and is consequently used in the high grade exterior varnishes. Kauri comes to us in various grades, ranging greatly in physical characteristics and price. The better quality Kauri, for instance, costs at the present time $.90 per pound. The No. 1 Kauri costs $.50 per pound, while the Brown Kauri costs $.15 per pound. The varnishes made with these various grades of Kauri have, of course, the same general properties, yet differ so considerably that it is most important that the grade of gum be considered very carefully in the manufacture of a varnish.

The Manila Copal is a type of the resins which are termed soft resins, and comes to us mostly through the port of Manila, being found largely in the East Indies. White Manila is used a great deal in the cheaper interior and medium priced varnish, and when handled properly some very good results can be obtained. However, it carries quite a large amount of free acid and has the property of causing a varnish to have a softer film than one made with the Kauri or the other harder gums. Manila, like Kauri, comes to us in various grades, the best being the White Manila and a cheaper grade being the Manila Nubs, which is a form very popular with the varnish manufacturers on account of the fact that the Manila Nubs, being small pieces, are much easier to handle than the White Manila, which comes in extremely large pieces. The Manila gum is derived from one of the most prolific gum-bearing trees known, and some of the pieces of gum which have been found are very large in size, being sometimes two or three feet in diameter.

The Damar resin is a gum which is probably very familiar, having been used for years in the manufacture of Damar varnish. Its one important feature is its color, and that is about all which we can say for it. It has no durability, is very soft, and a resin with a very low melting point, so that it cannot be used in any of our high grade varnishes. Damar resin has been used for a great many years for the manufacture of white enamels and for a considerable length of time all the white enamels on the market were made upon this base. Today, however, the highest grade of white enamels contain no Damar on account of the fact that it is lacking in durability. We still, however, have a great many cheaper, quicker drying, and less durable enamels, which are made upon a Damar base.

The Asphaltum is not really a resin, being a cross between soft coal and petroleum, and comes to us largely at the present time from Utah. This bituminous material is used in the manufacture of our black air drying and baking japans, being used largely upon iron work.

While the above does not describe all of the resins which are used by the varnishmaker, yet it gives an idea of the various properties which the varnishmaker obtains by using the different grades and kinds of resins, and we shall now proceed to give a brief description of the various ways in which these resins are gathered. As mentioned above, these resins are formed by a fossilization of the sap, which came from trees, which existed thousands of years ago, and it is of particular interest that many of these resins are found as deep in the earth as twenty or more feet.

The gum digging industry in the early days, particularly in New Zealand, was for many years carried on in a desultory manner, with the result that practically no gum was procured except that which lay on the surface. The gum diggers in the olden days would start out in the morning with what they termed their prodding stick and knapsack on their backs and by the use of this stick would determine places where the gum could be found. They would proceed to dig up the gum and carry it with them until evening, when they would sit around their camp fires and scrape the gum and prepare it for the market. Today, however, the gum digger is more like our modern miner. He starts off with his various prospecting sticks, his spade and coarse tooth saw, with which he saws around the roots and moss in order to unearth the gum. The surface of the earth, is then dug up and the gum and dirt thrown to one side. This digging goes on until at times we find diggers have proceeded to a depth of twenty feet below the surface of the earth in their search of gum. The gum is then thrown upon a screen, where it is washed and the earth and other decayed matter separated from it. The gum is then all scraped and sorted, and then carried down to a general warehouse, where it is further sorted and graded. The gum is then taken to the brokers' warehouse where it is further sorted by men who have wide experience in this line. These men start as mere boys, first working on the cheaper gums and then they are gradually promoted to work on the higher grades of gum. This is very important work when we realize the variations in its price. The gum is then put into bins, and from the bins is packed in cases, then shipped to foreign ports.

We now pass on from the subject of gums to that of oils, and the first oil we shall mention is, of course, Linseed Oil, which is made from the flaxseed grown in Canada, United States, Argentine, India, and around the Baltic Sea, and it is very curious to note that the oil from these various parts of the world should differ so much, due probably to climatic conditions and also to methods of harvesting.

The flax is cut in the field and the flaxseed is then separated from the flax stalk. This seed, in the case of that grown in our own country, is then carried to the various lake ports and comes down the lakes in large grain boats. The seed is then conveyed from the boats to the grain elevator, and is separated according to the various grades and the source from which it comes; it is then carried by means of large conveyors to the rolls. These consist of large steel corrugated rolls between which the seeds pass until they are entirely crushed into the form of a fine powder. This powder is then emptied into the tempering kettle on the floor below, where a certain amount of moisture and heat is applied by means of steam, the proper amount of moisture and the correct temperature being judged by the workman, who is very expert at this particular trade, gauging the temperature and moisture by the feel of the seed in his hand. When the powdered flaxseed is in proper condition the seed passes out under the "former" between two camelhair mats. It is then placed in the presses, the mats being one above the other and when the

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press is entirely set up a large hydraulic ram forces the mats together, pressing out the oil from the seed.

The material left in the press is the linseed oil cake, and all the surplus oil is found at the edge of the cake. The cake is consequently passed through a trimming machine, which takes off this edge and the cake is then baled up ready for shipment and the trimmings are sent back to go through the process once again. This cake is used largely for a cattle food, and the largest portion of it is shipped abroad to Belgium and Holland.

The oil is then filtered by filter presses, passing through filter cloths, and is now ready to be filled into the barrels. Thus we have our raw linseed oil. The oil at this point, however, is not in proper condition for use by the varnish maker on account of the fact that when heated to a temperature of about 450 degrees F., mucilaginous material, otherwise known as the "Break," separates from the oil. Consequently it is necessary that the linseed oil manufacturers further refine the oil, which is done by means of various chemicals and mechanical devices in order to produce an oil which will meet conditions imposed by their customers. At this point also the various driers are added to the oils in order to prepare the boiled oils found upon the market.

The next oil we shall consider is an oil which perhaps, is not quite so familiar as linseed oil, being our China Wood Oil, an oil made from the nuts of the Tung tree, a tree indigenous to China, growing largely in the interior of China, particularly along the banks of the Yangtse River. These trees bear fruit about the size of a small orange, each fruit containing five segments, each segment containing a kernel. The fruit is roasted over a fire, which breaks open the segments, the kernels separate and these kernels are then placed in the crushing machines.

The Chinese in the olden days used an extremely crude piece of apparatus for crushing these kernels, being nothing more or less than a large stone, which is rolled back and forth in a trough and crushes the kernels. A more modern crusher consists of a large stone weighing several tons; this is drawn around within the circular trough by means of mules, horses or other animals, and the kernels as they are crushed, gradually move toward the center. It is a very primitive means of carrying out these processes, but it must be remembered that individual Chinamen carry out the process on their own farms and therefore, the machinery cannot be very complex. The powdered China Wood Oil nuts are then tempered and placed between bamboo mats, and heated over a kettle of boiling water until the powdered nuts have picked up sufficient moisture and the mats are then placed edgewise in the large press. This press also is of primitive style, consisting of large mats, and a large wooden ram forces the logs between which the mats are set edgewise together, pressing out the oil. The oil is then filtered through bamboo cloths, and is then carried down to the China Wood Oil broker in large baskets, the baskets being lined with a peculiarly oiled paper. Each Chinaman carries four baskets, two being suspended from two sticks swung across the shoulders; each basket of oil which is purchased is tested and its richness determined. The oil is then emptied into the tanks, and from these tanks is drawn off into the barrels, in which it is shipped to varnish manufacturers. China Wood Oil being very different from linseed oil, and in fact, from any of the other oils, we will mention three of its chief characteristic properties. China Wood Oil when allowed to dry by itself on glass, instead of drying with a clear, transparent film as does linseed oil, dries with a cloudy opaque film, very much resembling a piece of ground glass. Secondly, China Wood Oil when heated at a temperature of about 450 degrees F., instead of gradually thickening as does linseed oil, it almost instantly goes over to a solid jelly very much resembling soft rubber. Thirdly, China Wood oil when placed in a bottle and exposed to the light, even though the bottle is air-tight, will, by the actinic rays of the sun be converted to a lard like mass. This last property is very easily overcome by the heating of the oil. The gelatinizing of the oil is also very easily taken care of by proper treatment with various gums, etc. However, the most difficult feature to overcome is that of the "dry-flat," as the varnish maker terms it. This is due to a wrinkling of the varnish film, and I would add it has cost the varnish manufacturer a great deal of money, and they have spent a great deal of time in order to overcome this very serious drawback. However, after years of study the larger manufacturers understand this property thoroughly and have overcome it entirely.

You may ask with all these drawbacks, why it is that the varnish maker should care to use China Wood Oil at all. In the first place, China Wood oil has two important properties which are not found in linseed oil. A varnish made with China Wood Oil will be very much more waterproof than that made with Linseed Oil. In the second place, China Wood Oil has the property of causing the varnish to harden very much quicker than when Linseed Oil is used. These two properties make China Wood Oil a very important and essential feature in certain classes of varnishes. On the other hand Linseed Oil produces in a varnish greater elasticity fuller body and lustre, better flowing properties than can be obtained with China Wood Oil. In producing a varnish, it can readily be seen that it is necessary to utilize each of these oils according to the results desired in the varnish. If, for instance, we desire to produce a spar varnish which must needs have a maximum amount of elasticity in order to stand expansion and contraction due to weather conditions, it is necessary for us to use the most elastic materials which we can possibly obtain, consequently Linseed Oil gives us for this purpose the best results. China Wood Oil, on the other hand, when used in a spar varnish attains its waterproof qualities very much quicker upon exposure, will retain a perfect film only for a short period of time after which the film deadens, cracks and makes an extremely poor surface for refinishing. The Linseed Oil varnish on the other hand while it dries and hardens more slowly and possibly, if rained upon, before it has hardened, will turn white (this whiteness disappearing upon its drying out) yet, at the end of about six months, the film will have worn evenly, and the varnish will have retained a good portion of its lustre.

If we now desire to produce a floor varnish, we must bear in mind that the necessary requisites of a varnish of this kind are that it must be very tough, elastic, waterproof and hard drying. This last property meaning that it must not soften up in warm, humid weather. In designing a floor varnish, we must of course look to the China Wood Oil for our waterproofness and, to a considerable degree, our hard drying properties. At the same time, we must look to our Linseed Oil in order to obtain the maximum amount of elasticity in the varnish film. This latter property is one, which is extremely important and which really determines whether or not a varnish will wear down evenly or whether it will crack and chip. Most people do not realize the amount of stress caused by the impression of heels

on a varnished floor, but upon considering this point, you can readily understand that it is necessary to have the maximum amount of elasticity in order to obtain the very best results. Thus, you can realize that in making a varnish for a definite purpose it is necessary to use those properties found in each of these oils in order to obtain a properly balanced product, and this only serves to emphasize the importance of specifying for definite kinds of work the varnish which has been especially designed for that purpose.

We will next take up the subject of Turpentine which is made from the sap, that comes from our southern pine trees. These trees were formerly cut according to the "Box Method;" that is, a box was dug at the base of the tree and the bark then cut from its side. The sap flowed down the side of the tree, ran into the box and was emptied from the box into a basket, then into barrels in which it was carried to the still. Today, however, on account of the fact that this method shortens the life of the tree, undermines its resistance to storms and thus permits great losses, we have perfected what is known as the "Cup and Gutter System." That is, the sap runs down the side of the tree into a gutter and then from the gutter into the cup, thus the tree is not wounded except on its side, and it is found that the production of sap is greatly increased as well as its quality improved. Furthermore, the trees last a great deal longer and there is not the danger of the entire destruction of forests by wind storm. The sap after being gathered from the tree is then taken to the still, where, a small amount of moisture having been added, it is heated in a large copper retort; the turpentine passes over as a vapor, through coils, is condensed and we have our gum spirits of turpentine. The residue left in the retort is rosin, which is subsequently strained, cooled and prepared for the market.

The material which I have just described is known to the trade as Gum Spirits of Turpentine and it may be well to mention the difference between this product and Wood Turpentine. Gum Spirits of Turpentine is, as I have described, made by the distillation of the sap of the pine tree, whereas, Wood Turpentine is made by the distillation of the wood itself usually utilizing for this purpose, the stumps of pine trees which have fallen. Both of these products are very similar in chemical constitution and in many cases can only be distinguished by their odor. It may be of interest to know that the American Society for Testing Materials in drawing up their specifications for turpentine have adopted a specification to which a high grade of Wood Turpentine can conform based upon the fact that the latter when conforming to this specification is equal in every way to the Gum Spirits. It is important, however, in permitting the use of Wood Turpentine to insist that it conform to such specifications as these, as there are upon the market many grades which have entirely different properties and which should, under no circumstances, be used.

Having discussed the various raw materials used in varnish making, we will now describe briefly the varnish making process.

The gum or resins usually in approximately one hundred-pound lots are placed in a copper kettle, which stands about three feet high and about two and one-half feet in diameter. The kettle is then rolled upon the fire, the gum melted and held there until a certain proportion of the gum has been distilled off. At this endpoint, which is determined by the varnish maker, the melt is drawn from the fire and the oil, which has been heating at an adjacent chimney and which had been previously prepared, is emptied into the kettle. The gum and oil are then thoroughly stirred together, the kettle being run back on the fire and the gum and oil heated until thoroughly amalgamated. This endpoint is also determined by the varnish maker, who has his own particular way of judging as to when the melt is finished and when the batch is completed. The kettle is then withdrawn from the fire and allowed to cool, when it is taken to the thinning room, where the turpentine or other thinners are added. The varnish is then pumped into coolers, where it is allowed to cool to a certain extent before passing to the filter presses, which take out all the dirt. This is done veery carefully, in order to take out the most minute particles of dirt and the varnish is then pumped to the ageing tanks, where it is allowed to age for a certain period of time, according to the quality of the varnish.

The question of ageing a varnish is one which has been given a great deal of study, and it has been proven that the ageing of varnish does improve it very considerably, both as regards its brilliancy and durability. This is apparently due to the fact that the various constituents of the varnish gradually become more and more closely knit together, which results in the improvement of the varnish.

While the matter of ageing is one, which has, in many cases, been very much overdrawn, yet, at the same time all manufacturers of the highest grade varnishes, even at the cost of tying up their capital, deem it sufficiently important to age their varnishes from one month to twelve months according to the character, grade and composition of the varnish. The completion of the ageing process is determined by tests made upon the varnish itself. After the varnish has been properly aged, it is then pumped to the filling tanks, from which it is drawn into the can or package, which is then labelled, and we have our finished product ready for the market.

ENAMELS.

431. In order to cover this subject fully, it will be necessary not only to consider the products that are termed "enamels," but also allied products such as enamel undercoatings, etc. We can, I believe, very logically divide this subject into two parts:

Architectural Enamels.

Industrial Enamels.

By Architectural Enamels are understood enamels and allied products which are used for the finishing of high grade work such as is generally found in private homes, etc.

By Industrial Enamels, we mean those products which are used for the finishing of wall work, etc., in factories and industrial buildings of all kinds.

We shall consider first the architectural enamels and at the start state that by an enamel we mean a product made by the combination of pigments and a varnish vehicle so as to form a product such that it may be used as a finishing coat. The American Society for Testing Materials defines an enamel as a special form of paint, which, when spread in a thin film, flows out to a smooth coat and dries to a smooth, glossy, relatively hard, permanent, solid when exposed to the air. An enamel always contains pigment and has considerable hiding power and color. Some enamels dry to a flat or eggshell finish instead of a gloss finish. Generally speaking, we would consider the difference between an enamel and a paint that the enamel is made by the combination of pigment and varnish, whereas the paint is made by the combination of pigment and oils, although

there may be drawn, of course, many exceptions to this definition.

Generally speaking, in all cases the method of manufacture is the same—the proper pigments having been selected, they are ground in a varnish vehicle to form a heavy paste. This heavy paste is then reduced with sufficient varnish to make the enamel workable or, in case of eggshell enamels, may be reduced with varnish and additional thinner, or in the case of flat enamels, may be reduced with a thinner such as turpentine or turpentine substitute.

We will not endeavor to describe completely the various pigments which are used in enamels. However, we will say briefly a little as to the principal pigments which are used in white enamels. In all the highest grade architectural enamels, especially those of the gloss and most of the eggshell, the principal pigment is zinc oxide. Zinc oxide is a pigment which comes on the market in various grades, although on high grade enamels, only the Green or the White Seal are considered suitable as pigments for the reason that other grades have not the pure white color which is necessary. Zinc oxide is an ideal enamel pigment for the reason that it is very light in weight and consequently stays well in suspension. Furthermore, it is an active pigment, combining with the varnish vehicle to form a coat which will have a good lustre and furthermore, on account of its chemical activity, an enamel may be produced which has wonderfully good covering properties. On account of the chemical activity of zinc oxide it is necessary to use a great deal of care in the selection of the varnish vehicle for the reason that when zinc oxide is combined with many varnishes, particularly those with a china wood oil base, the enamel will thicken up and become unsuited for use.

Lithopone is a pigment which is being used today in some enamels, although not in the highest grade enamels, for the reason that it has remarkably good covering properties, has good color and is an excellent pigment. However, it does not tend to combine with the varnish vehicle in such a way as to produce the lustre found in a zinc oxide enamel. It rather has a tendency to dull down the lutre of the enamel, and on account of this tendency has been used very largely in eggshell and flat enamels. Furthermore, considerable difficulty has always been experienced with lithopone in that it has a radical tendency to turn gray in the sunlight, a reaction due to the actinic rays of the sun.

Many other pigments such as Whiting, Asbestine, China Clay, Silica, etc., are being used in many of the flat enamels and flat whites as they are termed, all being comparatively inert and used on account of their price in many cases to cheapen the product, whereas other manufacturers use them for different scientific reasons.

Many manufacturers use Asbestine on account of the fact that it helps suspend the pigment, although any quantity of this material in a paint will hinder the flowing. Other manufacturers use Silica on account of the fact that it assists in the flowing, and where a considerable quantity of zinc is used does increase the durability and the tenacity of the material. Whiting is used many times to increase the flowing properties of a paint and China Clay is also used for this reason, and in order to improve the working properties of the product.

An enamel product should be judged more by what it does than by its composition, for manufacturers are learning today that many of the pigments which were held as adulterants a few years ago really have good reason for being in high grade enamel and enamel products and the architect in specifying enamel will do far better to consider the service that an enamel will give rather than its actual composition.

Eggshell and flat enamels are usually manufactured by using a sufficient quantity of pigment so that the pigment predominates over the varnish vehicle in such a way that the pigment comes to the surface, so to speak, and gives the semi-gloss or dull effect. Other eggshell and flat enamels are produced by the use of a vehicle such that it in itself has a tendency to dry out with a semi-gloss finish, which process does not necessitate the use of so much pigment and is really a more reliable product.

The subject of Undercoatings for use with enamels is one which is really covered by the subject of flat enamels in that an enamel carrying a large amount of pigment and having as good flowing properties as is possible, drying out either flat or with a slight sheen and manufactured in exactly the same way as is described above under the subject of flat enamels, is what is termed undercoating.

However, for architectural work, two kinds of undercoating are generally marketed—a regular enamel undercoating such as would be used on wood surfaces and an undercoating designed especially for use on cement, brick, etc., where it is necessary to use a special undercoating to resist the alkali in cement. Undercoatings of the former type are usually made on a lithopone base, whereas undercoatings for use on cement should be made on a zinc base, for zinc combined with a varnish vehicle produces a material which is very resistant to the alkali.

In undercoatings as in enamels the architect should, to my mind, refrain from specifying the composition of the material, but specify as to what the material shall accomplish.

Passing from the subject of Architectural Enamel, we wish to say a few words on Industrial Enamel, or what are commonly termed "mill whites."

These products are usually of three kinds:

Gloss.
Eggshell.
Flat.

The flat is used as an undercoating with the gloss and eggshell. In all three of these materials, lithopone is usually used as the basic pigment. The predominating feature in these products is the permanency of the white. That is, the ideal is a mill white which does not turn yellow upon standing. generally speaking, these products are not made with the same degree of care as architectural enamels. In many cases the grinding is not done as carefully and the lustre of the gloss enamel is seldom as high or as permanent as with the architectural enamel.

A very important feature with an industrial enamel is its working properties.

On account of the high cost of labor, usually only two coats are recommended for industrial work, although it is an established fact that far better work would be secured if three coats were used, so as to enable the use of a primer, especially on new work. However, practice has established that two coats is sufficient and two coats are generally specified.

One exception to this is the finishing of new concrete and cement where it is absolutely necessary for a special coating to be applied as a primer before the undercoating and enamel, if work of a permanent nature is to be secured, for the reason that otherwise, free alkali will attack violently the mill white and cause disintegration and discoloration in a very short time.

The above does not treat in any great detail of these various products, but we trust it will be of assistance to architects in making specifications, and in concluding I wish to particularly call their attention again to the fact that in specifying an architect should look to the service which a product gives rather than to the actual chemical analysis.

PROTECTIVE, PRESERVATIVE AND DECORATIVE COVERINGS

File Brush Using Trade.

STANDARD PAINTERS' MATERIALS.

An attempt is made in the following to define those materials which may be readily prepared by any competent painter, that are generally accepted as standard for high grade work. Such materials very properly form the basis of comparison for all proprietary paints. No proprietary preparation should be accepted for use that does not equal in enduring, wearing quality, appearance, cost and ground for subsequent coats, the materials hereinafter described.

Classification of preservative and decorative coverings is commonly made according to the nature of the surfaces which these materials are designed to cover.

Materials for painters' work are divided according to their nature under the following headings: Pigments, Binders and Agents or Solvents.

Paint consists of a binder or binders and a pigment or pigments incorporated or mixed together. Mixing of paint ingredients is accomplished in a manner either by stirring or grinding together by hand or by machinery. Machinery mixing with proper apparatus is most certain to secure uniformity of result, and is therefore advised where practical. It is practically impossible to get a perfectly smooth paint by hand mixing.

Linseed Oil is the only known universally successful binder for paint and the holding power of the paint depends almost entirely on the strength of the linseed oil used. This oil is adulterated in many ways, but the most common is with mineral oil. The manufacturers of mineral oil substitute have perfected their product to such an extent that it is difficult to distinguish it from the real article except by chemical test or actual use, when its inferiority is quickly manifest.

STANDARD BINDERS.

Raw Linseed Oil is the oil obtained from seeds of the Flax-plant, Linum Usitatissimum, and what is known as commercially, pure grade, has a specific gravity of not less than .932 nor in excess of .936, when the temperature is 15½° Centigrade, or at temperature 25° Centigrade, not less than .927 or more than .931. It has a minimum Acid number 6, Saponification number minimum 189, maximum 195. Unsaponifiable matter maximum 1.50%. Refractive index at 25° Centigrade minimum 1.4790 to maximum 1.4805. Iodine number (Hanus) 170. It is a straw yellow in color, weighs approximately 7½ lbs. to the gallon.

Boiled Linseed Oil, commercially pure, consists of raw linseed oil as above defined, kettle boiled at a temperature not to exceed 500 deg. Fah. nor less than 300 deg. Fah.; or the same sort of oil prepared with best pure Japan dryers, so as to increase drying qualites. If salts of lead or manganese are thoroughly incorporated into the raw oil, very similar results are produced to the boiling process. An old method of increasing the drying properties of linseed oil was to heat the oil to near the temperature at which it undergoes destructive distillation (550 deg. Fah. or thereabouts), and stir in at the same time, oxide of lead or oxide of manganese, or both. Such method, however, darkens the oil very much.

The U. S. Army Standard Specification for Boiled Linseed Oil Is as Follows:

Specification W. D. 2.

It shall be absolutely pure, well-settled linseed oil boiled with oxides of manganese and lead. It shall conform to the following requirements:

	Max.	Min.
Specific grav. at 15.5°/15.5°C.	—0.945	0.937
Acid number	—8.000	....
Saponification number	195.000	189.000
Unsaponifiable matter, pct.	1.500	....
Refractive index at 25° C.	1.484	1.479
Iodine number (Hanus)	....	168.000
Ash, per cent	0.700	0.200
Manganese, per cent	....	0.03
Lead, per cent	....	0.1

STANDARD SOLVENTS.

Spirits of Turpentine, chemically pure, is composed of a volatile oil obtained by the distillation of turpentine oil obtained by tapping or boxing yellow pine trees. It is a clear, colorless liquid, with a pleasant, pungent odor and shows a very slight residue when evaporated. Spread over any surface in a thin layer, it will dry in twenty-four hours, leaving practically no residue. Turpentine weighs about 7 lbs. to the gallon of bulk.

The U. S. Army Standard Specification for Turpentine Is as Follows:

Specification W. D. 3.

This specification applies both to the turpentine that is distilled from pine oleoresins, and commonly known as gum turpentine or spirits turpentine, and to the turpentine commonly known as wood turpentine that is obtained from resinous wood, whether by extraction with volatile solvents, by steam, or by destructive distillation. The bidder should state whether gum spirits or wood turpentine is furnished.

The turpentine shall be clear and free from suspended matter and water. The color shall be water white. The specific gravity shall not be less than 0.860 or more than 0.875 at 15.5° C. The refractive index shall not be less than 1.468 or more than 1.478 at 15.5° C. The initial boiling point shall be not less than 150° C. nor more than 160° C. Ninety per cent of the turpentine shall distill below 170° C. The polymerization residue shall not exceed 2 per cent and its refractive index at 15.5° C. shall not be less than 1.500.

STANDARD PIGMENTS.

Red Lead, practically pure from a commercial standpoint, is equal to 98 per cent lead tetroxide; but to secure this degree of purity, without a trace of soda or nitrate salts, requires a special method of reduction not employed by all manufacturers. In fact it has only been within the last few years that even the best manufacturers have been able to produce a pure red lead without having present from .1 to .5 per cent of soda or nitrate salts, which salts have a strong tendency to promote rust. Paint is intended as a protection of metal against rust, and as such should not contain any elements of a rust inducing nature. Specification should therefore require that red lead must be wholly free from soda or nitrate salts. The process now used to get red lead which is 98 per cent true, is by burning the lower grade red lead, 85 per cent true, for about 20 to 24 hours longer. This brings the true red lead, Pb_3O_4 up to the high standard which has lately been accepted as most effective in preventing rust. The American Society of Testing materials after exhaustive tests conducted within the last nine years have concluded

that the highest grade red lead, 98 per cent true, is even more lasting in character than the red lead which was formerly considered best for paint pigment which was about 83 per cent true red lead $Pb_3 O_4$ (tetroxide of lead) plus 17% litharge PbO (mon oxide of lead). The Government specifications have been raised from 85 per cent to 90 per cent true, and lately have been increased to 95 per cent of true red lead. (This observation does not apply to the war department which still follows the old standard).

This, therefore, argues very strongly for the 98 per cent true red lead, but it still remains a fact that very enduring paint can be made in compliance with the following formula: Pb_3O_4 (tetroxide of lead), 85 per cent plus litharge PbO (monoxide of lead) 15 per cent. Owing to the tendency of this combination of red lead and litharge pigment to unite with linseed oil in chemical combination, paint composed of red lead and linseed oil should not be prepared to exceed twenty-four hours before using. For if this combination of red lead and litharge is mixed with linseed oil and sealed up in an air-tight can, it will be found after a time that the mixture has solidified showing that the oxygen of the air which is the hardening agent in ordinary paints is not necessary. The chemical combination that thus takes place between the litharge and the oil in this mixture probably gives an increased toughness and endurance to paint applied according to this formula, provided this chemical action takes place after the paint is applied. Practically, it is very difficult to secure intelligence in the application of paint to structural portions of a building and it is therefore doubtful practice to use so large a percentage of litharge, not because it will not make a strong enduring paint, but because it is extremely difficult to get same applied before chemical action takes place. It has been found also that the addition of say 10 per cent of a practically inert pigment such as Princess mineral or oxide of zinc, increases the wearing quality of red-lead paint without other injurious effect.

The U. S. Army Standard Specification for Reinforced Red Lead Paint Is as Follows:

Specification W. D. 40.

Pigment 64 per cent.
Liquid 36 per cent.

The pigment portion shall consist of Red Lead (not less than) 60 per cent, the balance to be Silicious Matter, such as Aluminum Silicate, Magnesium Silicate, Silica or a mixture thereof.

The Red Lead used shall contain not less than 85 per cent $Pb_3 O_4$, the balance to be PbO.

The liquid portion shall consist of—

Pure Raw Linseed Oil (not less than) 90 per cent, the balance to be combined Drier and Thinner. The thinner shall be Turpentine.

Special Requirements: The paint must weigh not less than 16 pounds per gallon. It is intended to be used for a Priming Coat on Steel and when applied to smooth iron surface, it shall dry in 12 hours without running, streaking or sagging.

Corroded Lead, Basic Lead Carbonate chemically to $PbCO_3Pb(OH)_2$ is the form of lead pigment which has been in most general use for many years past. A satisfactory formula for white lead pigment is 70 per cent to 75 per cent of lead carbonate to 25 to 30 per cent of lead hydrate; this is in substantial compliance with U. S. Government standard specifications. While Basic Lead Carbonate is more poisonous than sublimed lead it still is a perfectly safe pigment to use with proper precautions. In fact nearly all paint pigments are more or less poisonous and so care should be taken by painter to avoid allowing paint to come in contact with the skin.

Sublimed Lead or Basic Lead Sulphate chemically to $PbSO_4PbO$ is coming into general use for paints and is practically non-poisonous and is just as valuable as a pigment for many purposes as the older form. It is particularly satisfactory as a base for tinting colors.

The U. S. Army Standard Specification for White Lead Basic Sulphate Is as Follows:

Specification W. D. 49.

The dry pigment shall be of the best quality, amorphous in structure, and of great opacity.

It shall contain:

Not more than 0.5 per cent Moisture,

Not more than 8.5 per cent Zinc Oxide (ZnO).

Not more than .075 per cent Sulphur Dioxide (SO_2), and

Not less than 12. per cent Lead Oxide (PbO).

Unless otherwise specified, this Basic Sulphate-White Lead shall be delivered in paste form, finely ground in pure, clear Raw or Refined Linseed Oil in the proportion of:

90 pounds Pigment.

10 pounds Oil.

White Lead Paste averages to contain by weight 92 per cent dry lead pigment and 8 per cent linseed oil and weighs about 38.1206 lbs. to the gallon of bulk.

Zinc White is oxide of zinc made by burning zinc in air. It is whiter than White lead but is not so opaque, and more coats of zinc paint are necessary to get a given effect over a dark background than of white lead. Paint consisting of commercially pure zinc white and linseed oil makes a strong and enduring wearing surface but does not produce as satisfactory ground for repainting after a period of service, as paint composed of a white lead pigment and linseed oil.

Combination Paint composed of an admixture of right proportions of White Lead and Zinc White with Linseed Oil will undoubtedly give better service than either White Lead and Oil or Zinc White and Oil alone, possibly for the same reason that two or more sizes of aggregate rightly proportioned make a better concrete with a lesser amount of cement than aggregate of only one size.

Graphite, or plumbago, may be said to be diamond plus heat; for if a diamond is heated to a very high temperature, without access to the air, it swells up and is converted into a black mass exactly resembling graphite in every particular. This theory being further verified by the fact that this change takes place without the loss or increase of weight. Graphite is found in nature in large quantities. It is sometimes found crystallized, but in a form different from diamond. Graphite can be prepared artificially by dissolving charcoal in molten iron; from such a solution graphite is deposited on cooling. Pure graphite is dark grayish-black in color and of a metallic luster. It is quite soft, leaving a leaden-gray mark on paper when drawn across same. It is used in the manufacture of the so-called lead pencil and is sometimes called black-lead. Such designation is wholly misleading, as it is in no sense metallic lead. Graphite is pure carbon, the element which is the principal constituent of all organic matter, both vegetable and animal. It is extensively used as a paint pigment, particularly for metal coating. Finely

ground amorphous or non-crystallized graphite, when mixed with linseed oil, forms a perfectly inert pigment when united in mechanical mixture with the oil and without the slightest evidence of chemical combination. For this reason prepared graphite-paint is not injured by age as is the case with oil-paints, which are composed of oil and a pigment which will form a more or less stable chemical union with same. It is contended, by advocates of Graphite paint, that the inert nature of graphite pigment contributes to the ease of its application and adds to its covering capacity and elasticity, making a better appearing mechanical job with less labor and also a covering which can accommodate itself to the contraction and expansion of the material covered without serious injury to its efficacy as a protective covering. The non-active nature of graphite pigment makes it possible to coat surfaces with a much thinner coating than with the paint containing a pigment which acts chemically with its oil.

Lamp Black is a very finely divided form of charcoal produced by the deposit on cold surfaces of the imperfectly combusted products from burning oil. Lamp black may be said to be the soot produced by burning oil without sufficient oxygen present to form perfect combustion. This soot is largely made up of fine particles of carbon. Lamp black is used in the manufacture of ink and as a pigment for paint to be applied to metal. Many of the best contracting painters insist that lamp black ground and mixed with linseed oil forms the most enduring and attractive appearing paint for ornamental iron.

Paint for metal, first coat, should not be applied until after the surface is thoroughly cleaned free from dirt or grease, as such material keeps the coating from coming in contact with the metal, so that it cannot adhere to same. It might be supposed that grease would be absorbed by paint or varnish but this does not prove true in practice. To mix such materials would require their thorough agitation together. This is prevented in the application over dirty surfaces due to the fact that the grease is always mixed with and covered by an adherent film of dirt, which interferes with the action of the paint or varnish upon it; consequently making a loose film which will not permanently support the paint coating.

Colors are produced by mixing the various color pigments with the standard base pigments of lead or zinc.

The addition of Tinting Colors to White paint generally greatly increases the durability of the paint. The volume of base pigment needs to be reduced in proportion to the amount of color pigment added, so as to maintain the same relative relation of pigment to oil in the various coats as hereinafter prescribed. The scope of this article does not permit a discussion of the composition and merits of the numerous commercial color-pigments offered to the trade.

Chemical action between the pigments and oil in paint ordinarily does not occur, but there are exceptions. Sabin states that such action takes place with White Lead and Linseed Oil, "probably between the oil and the lead hydrate, which constitutes at least a quarter of the pigment." "This change is said to be due to resinification of the oil converting it into a sort of varnish." "Zinc Oxide (White Zinc) also acts on oil, but in a much less degree." "Paint consisting of White Lead and White Zinc mixed together in the proportions of two of lead to one of zinc is reputed to be superior to either alone. Zinc brushes more readily and is said to have a spreading capacity of 50 per cent greater than a straight lead and oil paint.

Paint Proportions and Covering Capacity.

Primer of Lead and Oil for new work should be proportioned by bulk, so as to contain 27 per cent of White Lead Paste, 62 per cent of Linseed Oil and 11 per cent of Turpentine.

Priming Lead and Oil will require 10.3 lbs. White Lead, .62 gal. Linseed Oil and .11 gal. Turpentine to make one gal. of paint.

One Gallon Lead and Oil Primer will average to properly cover about 2¾ squares of new wood work or 1¼ squares of common brick work.

One Square of New Wood Work requires to properly prime same with lead and oil 3¾ lbs. White Lead, .23 gal. Linseed Oil and .04 gal. Turpentine, or if common brick requires 8.24 lbs. White Lead, .5 gal. Linseed Oil and .088 gal. Turpentine.

Succeeding Coats of Lead and Oil Paint after primer should be apportioned by bulk so as to contain 30 per cent White Lead, 64 per cent Linseed Oil and 6 per cent of Turpentine.

Succeeding Coats of Lead and Oil Paint after priming will require 11.44 lbs. White Lead Paste, .64 gal. Linseed Oil and .06 gal. of Turpentine to the gal.

One Gallon Lead and Oil Succeeding Coater will average to properly cover, any coat, about 4½ squares of wood work after same has been primed, or 3 squares of common brick work, second coat. Third coat on brick work, one gal. will cover as much surface as on wood.

One Square of Any Oil Succeeding Coat on wood work after same has been primed will average to require to properly cover same 2.54 lbs. White Lead, .14 gal. Linseed Oil and .0133 gal. of Turpentine; or for 2nd coat on common brick work, 3.48 lbs. White Lead, .21 gal. Linseed Oil and .02 gal. of Turpentine. Third coat on brick work will require the same amount of paint to unit of surface as "Succeeding Coats" on wood.

Primer for metal of red lead to give satisfactory results can be made by mixing 23 lbs. of dry "red lead for painting metal" to 1 lb. of "zinc white," adding sufficient commercially pure "raw linseed oil" to make a gallon of the mixture, and thoroughly incorporating together. The mixing of the oil and pigment should only be as required at the work, never to exceed 24 hours before applying. The paint resulting will be rather stiff and requires thorough and careful brush work to make the surface elastic, and the material cover proper area. This paint should not be thinned by addition of evaporaent liquids as these have a tendency to produce destructive chemical action on the paint, effecting its permanency as a protective coating.

Succeeding coats on metal, after primer, can very satisfactorily be of white lead and oil or zinc paints as above described, or a combination of the two.

Primer for masonry surface which has a strong alkaline reaction, such as plastered walls, brick masonry and concrete, should consist of a solution of zinc sulphate crystals dissolved in water, in the proportion of 3 lbs. to the gallon, after which succeeding coats of paint as defined above for wood work may be applied with satisfactory results. Oil paint should never be applied direct to masonry. There are a number of proprietary mixtures that are prepared especially for this purpose and which give excellent results.

Cheap Practical Substitute Oil Paint for more or less temporary use is illustrated by

the U. S. Government War Department "Exterior Cantonment Paint" Standard Specification, which is as follows:

"W. D. 19"

This Paint also to be furnished in white when required.

Pigment 64%.
Liquid 36%.

The pigment portion shall consist of—

White Lead (Basic Carbonate, Basic Sulphate, or a mixture thereof).....42%
Zinc Oxide 33%
Aluminum Silicate, Magnesium Silicate, or a mixture thereof, combined with the necessary pure tinting colors to produce the desired shade (a total of) 25%

The liquid portion shall consist of—

Pure Raw Linseed Oil.................20%
Menhaden Oil, * Soya Bean Oil, ** or a mixture thereof......................40%

The balance to be combined Drier and Volatile Mineral Spirits.

Special Requirements: This paint shall weigh not less than 15 pounds per gallon, and shall dry within 12 hours, and leave a surface suitable to recoat in 36 hours.

The above name and standard specification applies wherever similar type of paint is to be used.

* The Menhaden Oil used in this paint shall be pure, refined, light in color, and not of objectionable odor. It shall have the following chemical constants:

Specific gravity......................	.92-.93
Iodine number, not less than.........	166
Saponification number, not less than	186
Acid number, not more than..........	8

**The Soya Bean Oil used in this paint shall be pure, light in color, and shall have the following chemical constants:

Specific gravity......................	.92-.93
Iodine number, not less than........	130
Saponification number, not less than	180
Acid number, not more than.........	4

Flat Finish Interior Paint

The most satisfactory Flat Wall Paints are made with Lithopone as the principal ingredient in the pigment. Lithopone is a wonderful pigment for interior use. It has great hiding power and spreading capacity and when properly mixed with the right kind of liquids makes the ideal inside flat wall paint. There are many standard brands of flat wall paints on the market that are worthy of consideration and use.

Fire Retardant Paint
U. S. Army Standard.

W. D. 21.

In any Tint desired.
For Exterior Use on Lumber Construction Wherever Fire Resistance is Desired.

Specification.

White Paint and Tinted Paints made on a White Base.

Pigment 60%.
Liquid 40%.

The pigment portion shall consist of—

Basic Sulphate White Lead............28%
Zinc Oxide..........................22%
Magnesium Silicate, combined with the necessary pure tinting colors to produce the desired shade (a total of)....50%

The liquid portion shall consist of—

Pure Raw Linseed Oil (not less than)—55%

The balance to consist of equal parts of Drier, Turpentine and Volatile Mineral Spirits.

Special Requirements. This paint shall weigh not less than 13 pounds per gallon. When applied to new lumber construction it shall penetrate and dry rapidly to a durable film. It shall successfully withstand the standard firebrand test when applied to two-coat work.

The above named and standard specification applies wherever Fire Retardant Paint is to be used.

WOOD FINISHING MATERIAL.
Orange Shellac Varnish
U. S. Army Standard

W. D. 31.

Specification.

This material shall consist of 4½ pounds of Shellac cut in one gallon of Clear Neutral Denatured Alcohol. *

The Shellac used shall be a high grade Orange Shellac which, when treated with hot 95 per cent Alcohol, will not show a residue of insoluble matter exceeding 1.75 per cent.

The Shellac shall be free from Rosin and other adulterants.

The above standard specification applies wherever Orange Shellac Varnish is used.

* The alcohol used shall be No. 1 Internal Revenue Dept. Standard consisting of 100 gallons of grain alcohol and 5 gallons approved wood alcohol.

LIQUID WOOD FILLER.
U. S. Army Standard

W. D. 52.

Specification.

Pigment 17%.
Liquid 83%.

The pigment portion shall consist of—

Finely divided Silica that will pass through a 200 mesh screen.

The liquid portion shall consist of—

Varnish 77%

The balance to be Turpentine or Volatile Mineral Spirits, or a mixture thereof.

Special Requirements. When applied to wood it shall dry in not more than 5 hours. It shall be of the proper consistency for either brushing or dipping.

The above standard specification applies wherever Wood Filler is to be used.

Generally speaking, there is no great demand for a liquid wood filler. A thin coat of

shellac or a varnish thinned with turpentine are recommended for use in place of liquid fillers.

Paste Filler for open grained hard-wood finish or floors requires for proper filling and wiping 1⅔ lbs. Silex paste and .14 gal. thinner to the square. Paste Filler is tinted or left transparent according to the color effect desired. One pound of prepared paste filler will fill 40 square feet of surface.

Wiping of paste filler is done with burlap, sea moss or excelsior and should always be done across the grain of the wood as if rubbed with the grain of the wood there is a tendency to lift the filler out of the pores of the wood and waste same, requiring more filler to give satisfactory results.

Thinner for paste filler may be either Turpentine or Benzine if the filler is of best quality of rock quartz, water floated, very finely bolted and mixed with special Japans and Linseed Oil, benzine seems to give the most satisfactory results for a thinner owing to its quicker evaporation. For the cheaper fillers Turpentine must be used.

Varnish is discussed in another article in this book so is omitted here.

Stains for wood work usually form one coat in addition to filler and coats of varnish or wax; these are of three kinds, oil-stain, spirit-stain and water-stain, and are used according to the effect desired.

Oil-Stain averages to require about .16 gal. to the square.

Spirit-Stain averages to require about .16 gal. to the square.

Water-Stain averages to require about .2 gal. to the square.

Prepared Wax averages to require about .33 lbs. to the square.

Gloss Oil is a term used to designate a preparation composed of resin and naptha. This is a very cheap substitute for varnish often used as a size for plastered walls preparatory to tinting. It is a very inferior material and when used as a size softens and roughs with repeated washings. It is ruinous when used as a varnish or as a binder for paint.

Varnish, Best Light Interior, requires for properly coating one square, 1st coat over filler, 1-5 to 1-7 gal.

Varnish, Cheap, Thick Rosin, requires for coating one square one gloss coat, ¼ to ⅕ gal.

Cresote Stain required to dip ⅔ length one M. shingles equals about 2¾ gal.

Cresote Stain required to brush coat one square shingles equals one gal.

Size for plastered walls preparatory to tinting should be varied according to the nature of the treatment to be applied over same and also with reference to the surface on which it is applied. A very good size for this purpose on smooth plastered walls is a coat of medium grade varnish. Such a size would cost about $2.25 per gallon. A standard medium cost size for smooth plastered walls is made up of China wood oil, resin and naptha; such a size could be made up for about $1.50 per gallon. The cheap size commonly used is made up of gloss-oil at a cost of not to exceed 75c per gallon; but taking into consideration lasting quality and labor expended, this is most expensive and unsatisfactory.

Fresco Size satisfactory for use on rough plastered walls may be made up as follows: Dissolve each separately in the proportions of one pound of glue to one gallon of water, one pound common yellow laundry soap to one gallon of water and one-fourth pound of alum to one gallon of water; the glue and soap solutions then being mixed together first, and after thoroughly mixed, the alum solution added and the whole well stirred together ready for application to the wall.

ESTIMATES ON PAINTING.

PAINTER'S ESTIMATE=(units of surface to be covered) × (amount of material required to cover a unit) × (cost of a unit of material) + [(number of hours of labor required by a mechanic to apply the material to a single unit of surface) × (hourly wage of mechanic) × (number of units of surface)] + (overhead charges, including scaffolding, brushes, drop-cloths, cartage, office expense and expense of supervision, etc.) + **(Contractor's profit,** which varies with the supply and demand).

UNITS OF SURFACE USED ARE (one sq. ft.), (sq. yd.=9 sq. ft.) or (square=100 sq. ft.).

AMOUNT OF SURFACE UNITS assumed for estimating purposes is increased at the judgment of the estimator. This is done to make proper allowance for increased labor and waste of material on account of broken and complicated surfaces, and so that prices per unit of labor and material can be maintained constant, the following enumerations being the assumptions most commonly used by estimators.

PLAIN D. & M. Wainscoting or partition stuff is measured once, actual surface, and is used as the standard of comparison. Other surfaces are increased in proportion as their difficulty of execution compares with D. & M. Wainscoting.

Sash for exterior are measured over the entire area instead of around each bar.

Shingle Gable, 1½ × actual surface area.

Dormer Windows 2 × actual surface area.

Shingles, Rough, 1½ to 2 × actual surface area.

Shingles, Dressed, Dimension, actual surface measure.

Spindle work, measure 4 times solid on one side.

Square Spindle work and pickets, 4 × one side measured solid.

Verandas with heavy columns and railings, etc., measure surface of ceiling and floors and all sides the same as though enclosed. Veranda, very simple in design, measure floor and ceiling and allow double area of brackets and columns.

Outside Blinds, measure 3 × actual surface of one side.

INTERIOR.

Base Boards, measure not less than 1 foot in width regardless of actual width.

Picture Mouldings, measure 1-3 foot in width.

Single Doors, including trim, count as 35 sq. ft. to a side or 70 sq. ft. for both sides.

Interior Side of Windows, including trim and tracing of sash, average at 35 sq. ft.

Wall Decorations, measure ceiling solid and sidewalls 8-10 of actual area to allow for openings, or measure actual area and deduct ½ to ⅔ of all openings.

Badly Weathered wood work or cracked and damaged plaster, add from 1-10 to 3-10 to measurements determined as above.

Prices of standard materials are quoted in market reports and fluctuate with supply and demand. The estimator should verify these preceding each estimate. At time of going to press the following prices obtain:

White Lead Paste, $12.25 per cwt.

Linseed Oil, raw, 85c per gallon.

Turpentine, 82c per gallon.

Paste Filler, about 14c per lb. in 100-lb. packages or 12c in bbls.

Interior Varnishes, about $1.75 to $3.00 per gallon.

Stains vary so much in price that they can not be listed.

First Class Exterior Varnishes, about $4.25 per gallon.

Proprietary Oil Paints of best quality are sold to the painters at about $3.25 to $3.75 per gal., depending on color. The materials in a gal. of White Lead and Linseed Oil "Succeeding Coat" of paint costs exclusive of labor and coloring matter about $2.40 at present market prices and the labor of mixing by hand and the expense for colors brings this hand-mixed paint up in price to about the same as proprietary paints of equal quality. Unless the ingredients composing paint are thoroughly incorporated the paint is not satisfactory. This proper mixing, if done by hand, requires considerable expensive labor.

In figuring the cost per gallon of a lead and oil paint we should not overlook the fact that the only way to correctly figure the price of paint is to figure it by the cost per square yard and not the cost per gallon. One gallon of pure lead zinc and linseed oil paint, machine made, will cover from 350 to 400 square feet per gallon, two coats on the average job, while lead and oil, hand mixed, will cover approximately 225 square feet, two coats.

LABOR REQUIRED.

COST OF LABOR=(number of hours of labor required by a mechanic to apply the material to the single unit of surface) × (hourly wage of mechanics) × number of units of surface).

Wage per Hour=union scale obtaining in the locality where the work is to be executed. (In Chicago this is from 80c to 85c per hour prevailing wage at this time per hour under the award of Judge Landis).

Stopping knots with shellac requires in labor .2 of an hour's time to the square of surface.

Puttying defects in ordinary wood work requires in labor .3 of an hour's time to the square of surface.

Oil Painting, single coat, requires in labor .57 of an hour's time to the square of surface.

Paste Filler Coat, including cleaning of wood work, requires in labor 1.33 hours' time to the square of surface.

Varnish, single coat, including light sandpapering, requires in labor .66 of an hour's time to the square of surface.

Cresote staining of shingles by ⅔ dipping, requires in labor 1 hour of a mechanic's time to dip 1,000 shingles, which average to cover when laid, one square of roof surface.

Cresote staining, one brush coat on roof, requires in labor .8 hour's time to cover one square of surface.

Sizing of plaster walls with either glue or hard oil size requires in labor .33 of an hour's time to the square of surface.

Tinting with water color, fresco tints or calcimine averages to require in labor .44 hour's time to the square of surface to the man employed, providing not less than two men are employed on the work. (Ordinarily, one man cannot work alone at tinting of walls, for if he does so work, the work cannot be satisfactorily done and more time is required in proportion to the surface covered).

Sponging and washing walls requires in labor a variable amount of time to the square according to the amount of size used in coat to be removed and must be approximated by the estimator after examination and test.

PLATE GLASS.

Sizes and Thickness.—Plate glass can be made under the present improved methods in extreme sizes up to 250 square feet and in such measurements as 10 feet by 21 feet (or 120"x252") containing 210 square feet—12 feet by 20 feet (or 144"x240") containing 240 square feet—13 feet by 19 feet (or 156"x228") containing 247 square feet. Such extraordinary glass is very difficult to make, quite expensive and dangerous to clean or handle and, being especially made to order, entails delay in replacement when broken, requires special flat car shipment and special facilities for unloading and hauling, and the most expert and skilled glaziers in setting. Sizes are usually given in inches.

It is advisable to confine sizes to the ordinary limitations in order to secure prompt and economical deliveries from distributors' stocks.

On account of the extraordinary demand for certain sizes of plate glass for stock sizes in mirrors, windshields for automobiles, and stock door glazing, the proportionate production is below the consumption and a higher value is therefore placed upon these sizes, and their multiples.

¼" to 5/16".—Polished plate glass is manufactured in thicknesses ranging from ⅛" to 1½"; the standard product runs from ¼" to 5/16" full. The other thicknesses (whether thicker or thinner) are made specially, and at an increased cost.

The sash or rabbet for regular plate glass glazing should be made to accommodate glass full 5/16 of an inch thick.

Thick Plate.—⅜", ½", ⅝", ¾", ⅞", 1", 1¼", 1½".

Glass thicker than the standard product is used for counter tops, deal plates, port and deck lights on ships, aquariums, etc.

Thin Plate, ⅛" to 3/16".—One-eighth inch to three-sixteenth inch glass is used largely for residence windows and by car builders and for boat sash, automobile windshields, and for other special purposes where perfect surfaces, high polish and absolute clear vision is wanted, with minimum weight.

Weight.—Plate glass in regular glazing thickness (¼" to 5/16" thick) weighs 3½ lbs. per square foot bare and may be computed at approximately five pounds per square foot boxed for shipment. A rule for figuring shipping weight of plate glass is found in the official price-list as follows:

Extend the glass at 3½ pounds per square foot. Weight of box equals the contents of a plate of greatest width and length of those packed therein, multiplied by 10. Thus:

1 plate, 36"x96" } 1 plate, 60"x84" }	=59'x3½=206½	pounds.
Size of box 60"x96"=40'	x10=400	pounds.
		606½ pounds.

The raw materials may be said to be virtually the same in plate glass as in window glass—the main difference in the finished products being due to the great care exercised in selecting and purifying the ingredients, and the elaborate method of casting, grinding and polishing plate glass as compared to the simple and rapid process of producing window glass from blown cylinders.

Plate glass was first made in France in 1688 and the term "French Plate Glass" or "French Mirrors" has its origin from the development of the plate glass industry in France. The first cast plate made in the United States was produced in 1860 and perfected a few years later so that it may be noted that this is a modern product compared to window glass which was made during the early settlement of this country, at Jamestown, Va., about 1608. The making of ordinary glass has been included in the industries of almost every country in the world and dates back to ancient Egypt, centruies ago.

Ingredients.—The principal ingredients are silica (white-sand) soda (soda-ash) and lime (lime-stone). Also arsenic, charcoal and cullet (broken glass).

As stated before, the method of producing plate glass widely differs from window glass and it is little known that the melting, casting, rolling, annealing, grinding and polishing of plate involves the mining of silica and coal, the quarrying of limestone, the chemical manufacture of soda-ash on a large scale, the reduction and treatment of fire-clay and an elaborate system of pot-making for crucibles, all of which requires an enormous financial investment, a multitude of men, and extensive factory properties.

It should be stated that the product of the American factories is, by comparison, equal in every way to the European plate glass in clearness, freedom from flaws and defects, homogeneity and finish.

Special Quality and Thickness.—The making of irregular thicknesses, or superfine quality for mirrors or other uses where special glass is needed, requires special processes and entails additional expense in producing, and the making of beveled plates and mirrors necessitates two more elaborate lines of work and machinery and a corps of experts and skilled workmen.

Pot Making.—Pots of fire-clay are such a heavy expense in plate glass manufacture and take so important a part in the successful making of plate glass that the subject deserves special notice. The different clays after being mined are exposed to the weather for some time to bring about disintegration.

At the proper stage finely sifted raw clay is mixed with coarse, burned clay and water. This reduces liability of shrinkage and cracking. It is then "pugged," or kneaded in a mill; kept a long time (sometimes a year) in storage bins to ripen; and afterwards goes through the laborious process of "treading." No machinery has thus far been invented by which the plasticity can be developed as does this primitive treading by the bare feet of men. The clay must be treaded many times. The building of the pots is a slow, tedious and time-killing affair; but this is essential.

Without extreme care, some elements used in the making of the pots might be fused into glass while undergoing the intense heat of the furnace; or they might break in the handling, and much depends upon the strength of the pots.

The average pot must hold about a ton of molten glass, and the average furnace heat necessary is about 3,000 degrees Fahrenheit.

After completion comes the proper drying out of the pots; and this is another feature in which the greatest scientific care is required. No pot may be used until it has been left to season for at least three months, and even a year is desirable. And after all this, the pot has but twenty-five days of usefulness.

Melting and Casting.—The pot, having been first brought to the necessary high temperature, is filled heaping full with its mixed "batch" of ground silica, soda, lime, cullet, etc. Melting reduces the bulk so much that the pot is filled three times before it contains a sufficient charge of metal.

When the proper molten stage is reached the pot is lifted out of the furnace by a crane, is first carefully skimmed to remove surface impurities, and then carried overhead by an electric tramway to the casting table. This is a large, massive, flat table of iron, having as an attachment, a heavy iron

An Enormous Loss

Plate glass breakage causes the loss of millions of dollars every year. Insurance may cover the actual glass cost, but there is no way to recover the tremendous loss of time and inconvenience while waiting for a new glass to be set. Architects can save a great deal of money for their clients by recommending the installations of

ZOURI SAFETY METAL STORE FRONTS

Approved by Underwriters' Laboratories

Glass breakage due to faulty installation is next to impossible when Zouri construction is used. It meets with the approval of a greater number of architects every year. If you don't know about Zouri advantages,

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roller, which covers the full width, and arranged so as to roll the entire length of the table. The sides of the table are fitted with adjustable strips which gauge the production of plates of different thickness. The pasty, or half-fluid glass metal is now poured upon the table from the pot, and the roller quickly passes over it, leaving a layer of uniform thickness. The heavy roller is now moved out of the way, and then by means of a stowing tool the red hot plate is shoved into an annealing oven or lehr. The plates remain for some time in the lehrs, where the temperature is gradually reduced.

When the plate is taken from the annealing ovens it has a rough, opaque, almost undulating appearance on the surfaces. Only the surface, however, for within it is clear as crystal. First, it is submitted for careful inspection, and then goes to the cutter who takes off the rough edges and squares it into the right dimensions; and thence to the grinding room.

Grinding and Polishing.—The grinding table is a large flat revolving platform made of iron, twenty-five feet or more in diameter. This table is prepared by being flooded with plaster of paris and water; then the glass is carefully lowered, and men mount upon the plate and tramp it into place until it is set. After this, greater security is obtained by pegging with prepared wooden blocks; and the table is set in motion. The grinding is done by revolving runners. Sharp sand is fed upon the table, and a stream of water constantly flows over it. After the first cutting by the sand, emery is used in a similar manner. The plates are inspected after leaving the grinding room, and if scratches or defects are found they are marked.

There are also, not infrequently, nicks and fractures found at this stage; and in such case the plate must again be cut and squared, or if the defects are too great, the plate is broken up for cullet. The polishing is done on another special table by means of special reciprocating machinery, using rouge, (iron peroxide), applied with water, and rubbing the glass with blocks of felt so arranged that every part of the plate is brought underneath the rubbing surface. The grinding and polishing has reduced the original plate half of its thickness, sometimes more. The material washed away is lost and fully half the original weight of lime and soda has vanished, and even at the completion, the inspectors very carefully scrutinize the glass for excessive defects and reject that which is not up to quality.

Grading and Quality.—New plate is sea-green, looking at the "metal" through the edge, which gradually fades when exposed for a period to sunlight and weather, to a yellow or light brown color due to the action of the elements upon the chemical constituents of the glass.

In the finished product (glazing quality) there may appear some defects which in no way impair the value, beauty, or durability of the glass for ordinary use—such as small seeds or bubbles, short-finish, reams or surface scratches, which are accepted as contingent with the regular run of plate, and even an open bubble or shot-hole (not clear through both surfaces) is passed in standard glazing quality, providing the plate is comparatively free from other defects and of good color and finish.

Special Quality.—When glass of particular quality is desired, a special selection is necessary. This requires an expert in the grading and selection of the material, sometimes necessitates cutting down larger sizes to minimize the amount of defects inherent with the regular production, and adds a proportionate extra cost to special quality plate.

Beveling.—The beveling of plate glass is of such interest and exemplifies such skill on the part of the workmen that a description of the process should be added to the information already written in the preceding chapter on plate glass.

The glass to be beveled is subjected to treatment in different departments of the beveling plant, each division working out its particular process in taking off the bevel and restoring the surface of the glass to its original polish.

Five divisions of skilled workmen are necessary; namely, roughers, emeriers, smoothers, white-wheelers and buffers (polishers) using different abrasive or polishing materials, such as sand or carborundum, emery, sandstone, pumice and rouge.

The roughing-mill or wheel is a circular cast-iron disc having a fine cut corrugated surface about 30″ in diameter, revolving rapidly upon its bearings as a horizontal plane. Sand or carborundum is conveyed to the mill from above through a hopper with a stream of water, so that the sand gives the desired roughness between the iron and the glass while the water minimizes the friction and heat.

Roughing.—(1) The edge of the plate is brought into contact with the swiftly moving roughing wheel, and the sand cuts the bevel to the desired depth. Curved and pattern plates with incurves, mitres, etc., require an expert practiced eye and great skill on the part of the operator.

Emerying.—(2) In the first roughing process the beveled surface has been cut so deep by the coarse sand that it is necessary to follow with a finer abrasive in another mill to bring the bevel to a smoother finish, and emery or finer carborundum is used.

Smoothing.—(3) Then the rough grinding is still further smoothed in the stone mill, or smoother, which is constructed upon the plan of the iron roughing wheel, using a circular revolving sandstone of fine texture with water flowing upon it to reduce friction.

Polishing.—(4) The first polishing process is upon a wood wheel in an upright position which brings the bevel to a dull, milky polish by the use of powdered pumice in solution automatically splashed upon the wheel by a paddle.

Finishing.—(5) The final high gloss polish is put upon the beveled surface by the application of rouge upon the upright polishing wheel which is covered with a layer of thick felt.

Regular Bevel 1½″.—The standard width of bevel is 1½″ and all beveled plate glass or beveled plate mirrors are furnished with 1½″ bevel unless otherwise specified.

Slight scratches may be removed from the surface of plate glass by rubbing with pure thick felt mounted upon a hand-block, and using fine red or black rouge (moistened) as an abrasive. This must be skillfully done to avoid over-polishing or "burning" the delicate annealed surface of the plate.

Grinding and Polishing Edges.—The value of plate glass for furniture tops, desks and tables, show-cases, shelves and numerous other purposes has become generally recognized. The covering of glass with treated edges offers a clean, sanitary surface and an elegant appearance and also beautifies, protects and preserves the furniture.

The process of grinding and polishing the edges, or rounding of corners, curves or pattern lines, is similar to the beveling, except that the work is done on the edge of the plate instead of the surface.

The edge of the glass is rough ground, according to specifications, either rounded or squared or chamfered as desired, and finished through the polishing process—described in the previous chapter.

Wheel-Cut Mitred Work.—For decorative effects on door-plates, side-lights, transoms,

partition-glass, etc., the rich effect of mitred design gives a tone of elegance, and emphasizes the beauty of the glass.

The lines are cut V shape into the surface of the glass by a vertical wheel with sharp edges, and the smoothing and polishing is accomplished by the same general process as on the beveled edge. This is identical in appearance and presents the richness and beauty of the finest cut tableware.

Mitred designs on plate glass mirrors or on rolled figured glass produce an elegant effect where special and elaborate decoration is wanted.

WINDOW GLASS.

The quality of window glass or sheet glass, also termed "blown" or "cylinder glass," has been improved by the modern methods of production, and much has been expended in the effort to make perfect blown cylinder material. Yet there are still some waves and general defects accepted in all window glass, due to the process of making, which differs entirely from cast and polished plate.

The glass is blown in cylinder form and flattened by reheating, which gives it a slight bend or bow, a possible variation in thickness in the larger sizes, and surface flaws.

The selection of the various grades is a matter of expert judgment. The large sheets produced, in single or double thickness and heavier, are cut to stock sizes according to the merits of the glass and graded in "AA," "A" or "B" quality. The defects being eliminated to the greatest possible extent. The ingredients, as we have said, are practically the same in window glass as in plate—it is wholly a matter of refinement and process which produces the different kinds of material.

Window glass is made by two methods—by "machine" or by "hand." The difference is in the blowing process—both producing the cylinder from which all window glass is evolved. The same general treatment of the cylinder, to produce flat sheet glass follows in both machine or human blown material, and both produce equally standard quality.

To make the cylinder the molten glass or "metal" is brought to proper consistency by extreme heat, and the glass in the human blown process is "gathered" upon the end of a tube (or blow pipe) from the furnace and blown into a huge cylinder by repeated heatings and blowings, until the material is all evenly distributed. From a globular mass about the size of a man's head, the blower swings the pipe into an alley or opening in the floor, blowing as he swings until the full sized cylinder is formed. This requires skill of the highest degree—the blower, by regulating the amount of material entering the cylinder, makes single strength or double strength or heavier glass as desired.

The blowing machine accomplishes the same result by purely mechanical process—the intricate working of the mechanism, the supply of molten glass, the air pressure, rapidity of action, making single or double thickness, being controlled by a single operator who appears to have supernatural powers, surely never dreamed of throughout the great stretch of years when the glass-blower was master of the art and accredited with inimitable skill.

The cylinder is decapitated at both ends by an ingenious method of spinning a string of hot glass at the proper place, or by the use of a wire wrapped around the glass and electrically heated which causes the cap and crown to break off clean. The cylinder is then split lengthwise—placed in the flattening oven on a large circular stone, and as the heat is increased and as the glass begins to wilt it is quickly smoothed out to the shape of the flat stone, upon which it rests.

Cylinder glass cannot be perfectly flattened, and the waviness and bow or slight curve will always occur in this product.

In glazing, the bend or bow should be glazed outward in the sash—the bulge towards the exterior.

Sizes.—Window glass in double strength, or heavier, is made as large as 30"x90" or 38"x86" or 48"x80" and such extreme sizes containing twenty-five square feet, but it is inadvisable to use such glass in these measurements on account of the liability of breakage and the distorted vision due to waves, etc.

The same may be said of the extreme sizes of single strength which can be made up to 24"x60" or 30"x54" or 36"x50" in sizes containing ten or twelve and one-half sq. ft.

Crystal Sheet Glass.—A heavy blown glass, made by the same process as ordinary window glass and subject to the same inherent defects. Graded in "AA," "A" or "B" quality and made in various thicknesses: 26-ounce, 29-ounce, 34-ounce and 39-ounce ($\frac{3}{16}$" thick).

In examining samples of small size for inspection of quality, it should be remembered that the large light of glass will show the natural waves and defects, while the small piece may appear nearly perfect.

It is not altogether a matter of expert judgment to determine the various grades and certain rules may be accepted governing window glass specifications.

Thickness and Weight.—Single strength measures approximately twelve lights to the inch, but a small variation either way is permissible. Single strength weighs approximately 16 ounces to the square foot. Double strength measures approximately nine lights to the inch. The thickness should be fairly uniform and the weight approximately twenty-four ounces to the square foot.

Factory Packages.—Window glass is packed in regular sizes approximately 50 square feet to the box up to the 100 united inch bracket (adding width and length), and 100 square feet to the box in sizes over 100 united inches.

Shipping Weights.—Single strength in factory packages weighs from 65 to 75 pounds to the box (shipping weight). Double strength in factory packages weighs from 85 to 110 pounds to the box, 50 foot boxes, (shipping weight.)

Double strength in 100 feet cases weighs approximately 225 pounds (shipping weight).

"AA" or First Quality.—"AA" quality should be clear glass, free from any perceptible amount of air bubbles or blisters, burnt specks or burns, cords and strings. It should have a good gloss and an even surface and be well flattened. By air bubbles it is understood that tiny blisters, or imperfections not perceptible on the cutters' table, but detectable when placing the sheet directly towards the light, would not be objectionable. This should be a careful selection in both single and double and should represent the very best that can be produced in window glass by the present methods.

"A" or Second Quality.—"A" glass is the normal selection of glass when no special selection is desired or specified and it admits of such defects as small strings or lines, small blisters when not too close to one another or located in the center of the sheet. Well flattened, the surface even, and devoid of noticeable scratches, cropper marks, burns and other prominent defects.

"B" or Third Quality.—"B" glass covers a wider range than either "AA" quality or "A" quality. It permits many of the defects inherent to the process of making such as waves, strings, lines, blisters, scratches, burns and other similar or equivalent defects. This quality embraces everything below "A" quality, not stony or full of blisters or other

large defects objectionable for any common purpose, such as heavy scratches, heavy blisters, cords and sulphur stains.

26-oz. Crystal Sheet.—A cylinder or blown blass heavier than the ordinary Double strength, and graded by the same rules as window glass in first, second or third quality, measuring approximately ⅛" in thickness (technically 125/1000 of an inch).

29-oz. Crystal Sheet.—A heavier blown cylinder glass, graded as above (technically 135/1000 of an inch in thickness).

34-oz. Crystal Sheet. — A heavier blown cylinder glass, graded as above, (technically 159/1000 of an inch in thickness).

3/16" or 39-oz. Crystal Sheet.—A heavier blown cylinder glass, graded as above, measuring 3/16" in thickness.

While there is no uniformity in specifications governing the method of glazing different styles of glass, it is nevertheless advisable to call attention to some features which have been developed through the experience of the glass houses in this business.

It is especially desirable that all glass to be specified for a building be placed under one heading in the architect's specifications under the heading, "Glass and Glazing."

Accuracy is a necessity. Use a standard rule, true to gauge; specify the size plainly. For instance, 56 inches might be confused if written 5' 6", and cut 66 inches—as 5 feet 6 inches. Always specify width first. In measuring, it is advisable to allow a little play and measure inside the rabbet. See that rabbet is made to accommodate glass of the thickness ordered; i. e., order glass of proper thickness to fit rabbet. Measure the opening and see if all sides are squared. Especially if metal work is to be glazed, it is essential to have perfect fit, and in large sizes it is not uncommon to find a warped frame, or not exactly square, slightly different at one side as compared with the other.

Be specific. It is better to give an abundance of information rather than leave anything indefinite, or to be taken for granted. Mistakes will follow carelessness, and corrections involve loss of time and expense.

Plate glass should rest on two pads of felt, leather, lead, oakum or soft wood blocks, one near each end, not against bare metal, or at a single bearing-point which might cause breakage through settling of building, vibration, etc. The soft wood blocks or lead strips are to be preferred.

Do not fasten or bind glazing-mouldings too tight, as it is necessary to allow for expansion and contraction, vibration and readjustment of construction.

Use pure putty. Have sash-rabbet well oiled or painted so that putty will adhere. Give fresh putty glazing time to set before handling or hanging sash. Don't try to back-putty glass with corrugated or figured surface, as the putty cannot be removed from the ridges in the glass.

Steel sash glazing requires special putty for metal rabbets.

Caution.—When glass of any kind has been delivered to a building packed in cases or with paper between the sheets, it is advisable to store the glass under cover in a dry place and unpack it to avoid stains which come from drying out of damp hay, straw, paper, or other packing materials.

Glaze prism-glass with ribs inside—flat surface outside. Regular glazing is done with uncolored putty. If colored putty is desired it should be specified accordingly. Glass is not bedded in putty or back-puttied unless specially ordered or specified.

Window glass is regularly glazed with the natural bow or bend outside.

WIRE GLASS.

The use of metal frames, metal window sash and fire-proof construction has increased the demand for wire glass until the production of the material amounts to millions of square feet annually. Not only does this glass minimize the fire hazard, but its resisting and sustaining strength, its unyielding qualities even when cracked make it the logical glass for skylights, elevator shafts, stairwells, etc., where these features are a consideration.

Methods of Making.—Wire glass is made by three methods: 1. (Shuman process) by rolling a sheet of glass, laying the wire mesh upon it while the glass is still plastic, pressing the wire netting into the glass, and by a coincident process smoothing the surfaces. 2. (Appert or Schmertz process) by rolling a thin sheet of glass and laying the wire-mesh upon it and simultaneously pouring and rolling a second sheet of glass on top, imbedding the wire. 3. (Continuous or Solid process) by mechanically crimping the wire netting and placing same on the casting table and pouring and rolling the glass over it to produce a sheet of wire glass.

The introduction of the manufacture of wire glass is of so recent a date as to make the volume of consumption all the more surprising, especially when it is recalled that the product was comparatively unknown twenty years ago.

Standard Thickness ¼".—Wire glass is made in sheets as large as 60" wide and 130" long and in several thicknesses — ¼" standard thickness for general use and approved by the National Board of Fire Underwriters.

Other Thicknesses.—Thinner wire glass is obtainable—3/16" and ⅛" being made for special purposes, but the universal demand is for ¼" or ⅜" or heavier, and no wire glass less than ¼" thick is accepted under the rules of the Fire Prevention Bureaus or the National Board of Fire Underwriters.

Underwriters' Requirements.—It is necessary to follow certain rules and regulations in the making of fire-proof windows and construction, as provided by the National Fire Protection Association, and a copy of the requirements of the National Board of Fire Underwriters may be obtained from any member of The National Glass Distributers Association.

Extract from Rules and Requirements of the National Board of Fire Underwriters, Edition of 1906.

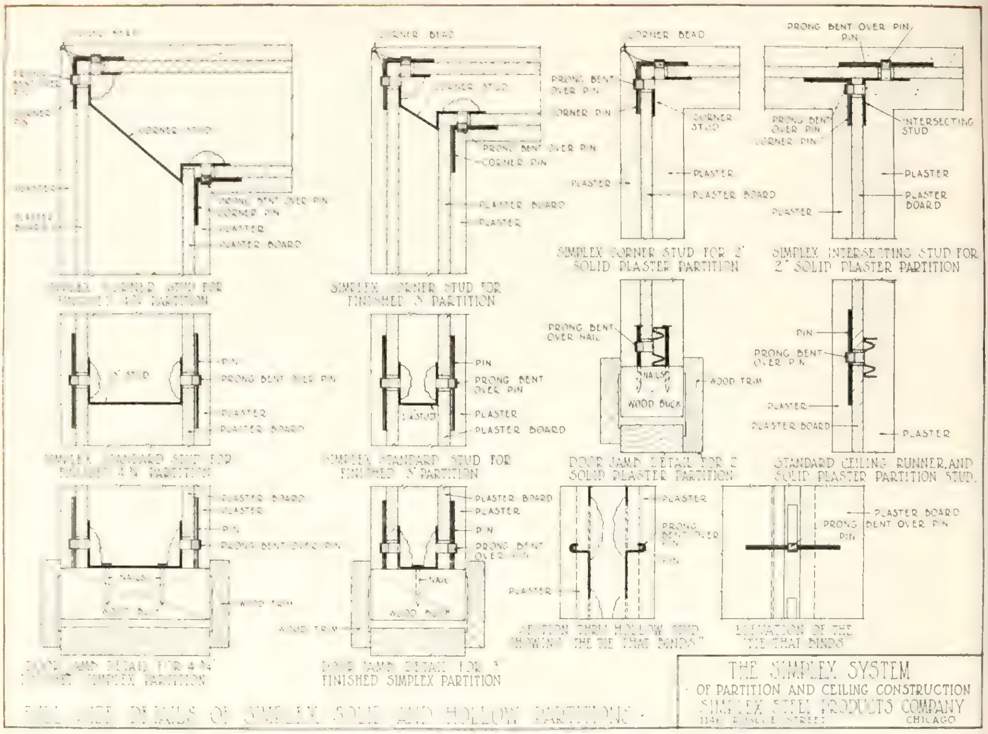
Thickness of Glass: Wire glass to have a thickness of at least ¼ of an inch at the thinnest point.

Size of Glass: The unsupported surface of the glass allowed, shall be governed by the severity of exposure and be determined in each case by the Underwriters having jurisdiction, but in no case shall it be more than 48 inches in either dimension or exceed 720 square inches.

Windows, doors and partitions should be specified for such sizes as 15"x48", 18"x40", 20"x36" and 24"x30" to conform to the above rule where dimensions are not to exceed 720 square inches. There are also restrictions and regulations governing the depth of rabbet (¾" deep) bearing of glass (⅝") and style of metal frames and sash to meet the demands of fire-retardant construction and permit reglazing, etc.

Polished Wire Glass.—Wire glass is made in ordinary rolled "rough" or "ribbed" or "figured" patterns, and when ground and polished for clear or transparent vision, is specified under the term:—"Polished Wire Glass."

This is not the quality of clear polished plate, but a polished rough wire glass, with the ordinary run of defects inherent with rough glass which has polished surfaces.



Reduction from Sheet of Full Size Simplex Details.

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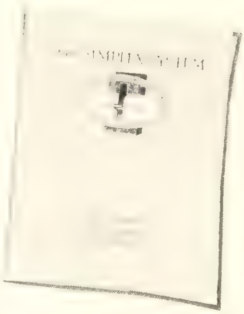
of Partition and Ceiling Construction

Architects find that by specifying Simplex System non-bearing partitions and suspended ceilings they can greatly reduce costs of construction and at the same time give the building owner a thoroughly high-grade, fire-proof structure.

Simplex Steel Studs and gypsum plaster boards and plaster are the materials utilized to produce strong, thin, light-weight partitions and ceilings that are both fire and sound resistive.



The patented design of the Simplex Stud and method of fastening the plaster board effect marked savings in labor, material and transportation costs. The System is adaptable to all types of buildings.

The subject is so broad and has so many phases that it is impossible to give you a thorough conception of Simplex advantages and methods except through our handbook or a personal demonstration. We shall be glad to give you this information and suggest that you call upon us.

This Handbook, profusely illustrated with photographs and blue prints, completely outlining The Simplex System, will be sent to architects upon request.

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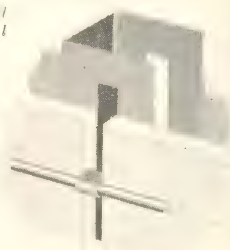


STANDARD RULES OF THE MEASUREMENT OF PLASTERING.

Adopted by the Employing Plasterers' Association of Chicago.

LATH AND PLASTERING

to be measured by the superficial yard, from floor to ceiling for walls, and from wall to wall for ceiling.

In rooms containing one or more horizontal angles between the floor and ceiling line, the ceiling to be measured from wall to wall, as though all walls were vertical, for contents of ceiling, and from floor to highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents on all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

No openings to be deducted from "solid" or "hollow" metal lath and plaster partitions nor for openings in suspended ceilings containing less than 100 square feet, where furring is carried around such openings by plasterer. No openings to be deducted from cement wainscot or base.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, "bullnoses," quirks, rule joints, and moldings, to be measured by the lineal foot on their longest extension, and one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of one foot girth or less to be measured on walls by the lineal foot. Plain cornices exceeding one foot girth to be measured by the superficial foot. Add one lineal foot to girth for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches by the piece. Ceiling or frieze plates over eight inches wide by the square foot.

COLUMNS.

All columns to be measured by the lineal foot for plain plastered columns.

CEMENT WAINSCOTING AND BASE.

All cement wainscot to be measured by the square foot, and cement base by the lineal foot.

GROUNDS.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

Grounds for 2-coat lath work	⅞ inch
Grounds for 3-coat lath work	1 inch
Grounds for 3-coat metal lath work	⅝ inch
Grounds for 3-coat metal lath work, on ½-inch iron furring	1⅛ inch
Grounds for 3-coat metal lath work, on 1-inch iron furring	1⅝ inch
Grounds for hard mortar metal lath work	⅝ inch
Grounds for hard mortar metal lath work, on ½-inch iron furring	1⅛ inch
Grounds for 2-coat work on brick or tile	⅝ inch
Grounds for hard mortar on brick or tile	⅝ inch
Grounds for hard mortar lath work	⅞ inch
Grounds for plaster board	⅞ inch

Where metal lath is spoken of it applies to all wire or metal lath.

The Employing Plasterers' Association of Chicago solicit the co-operation and support of Architects and others in the Association's efforts to set the highest standard possible for plastering.

In many of the branches of building construction, efforts are tending towards the use of better material and workmanship, no material or finish for a building combines so fully the essentials for fire protection and sanitation at so low a cost to the owner as does plastering, and no other material that enters so largely into the construction of a building presents so large an area of visible surface as does plastering. The cost of plastering represents only a small percentage of the total cost of a building.

It is a necessary base for the most expensive decorations and in itself provides the requisites necessary for a finish interior. The association believes that so important an element in the construction and finish of a building is worthy of being well done, and that the best workmanship and material if specified and called for will more than compensate owners and architects in their requirements for such grade of work. The Employing Plasterers' Association of Chicago respectfully submits the following outline specification for lath and plaster work; all trade names of material have been omitted. Architects will find a list of standard materials in the Hand Book and elsewhere.

TENTATIVE OUTLINE SPECIFICATION FOR LATH AND PLASTER WORK.

Sand. All sand to be clean, sharp lake sand.

Lime. All lime to be fresh burned lump lime.

Lath. All wood lath to be No. 1 white pine 1½" lath free from sap and bark and even edged.

Nails. To be 3 penny fine 16 gauge wire nail.

Wire Lath. To be No. 18 Washburn and Moen gauge .0475⅜" mesh painted or No. 24 gauge metal lath painted with ribs not less than ⅛" wide, lath cut from sheet metal shall weigh not less than 3.4 lbs. per square yard.

Stucco. To be fresh.

Hair. To be well whipped cattle hair.

Fibre. To be long vegetable fibre.

Portland Cement. To be a brand that shall meet the requirements of the standard specifications for Portland Cement of the American Society for testing materials as revised to date by said Society.

Hard Plaster. To be an approved straight gypsum plaster.

Metal Corner Beads. To be a bead not less than 24 gauge galvanized.

Lathing. All wood lath to be nailed to each stud joist or bearing with joints broken not over seven lath to a break, no diagonal nor vertical lathing allowed, a full ⅜" key to be left for lime mortar and not less than a full ¼" for hard plaster.

Lime Mortar. To be composed of clean coarse sand, fresh lump lime and hair and fibre in proper proportions and to be well slaked and protected.

Putty. Lime putty to be run off in a tight putty box, thoroughly tempered and screened through a fine putty screen.

Hard Finish. To be composed of cold run lime putty, fresh plaster of paris and sand to be well troweled to a smooth even surface, free from blisters, checks and other imperfections.

Sand Finish. All float sand finish to be composed of lime putty and sand to be

water floated with a float to an even granular or sand surface.

Scratch Coat. All scratch coating to be well laid on and surface covered with a full coat which is to be scratched with wire scratcher to be well under cut for the brown coat, all lime mortar scratch coating to be dry before applying the brown coat.

Brown Coat. All brown coating to be well applied, allowing only sufficient space for the finish coat, brown coat to be rodded and screeded with all angles straight and true, all hard plaster to be mixed in accordance with the directions of the manufacturer and no hard mortar to be floated with water nor shall any "dead" material be retempered or used.

Wire or Metal Lath. Shall be lapped at each joint or seam and shall be stapled every six inches with blued or galvanized staples.

Band Iron Furring. The following shall be furred with ¼", ½", ¾" or 1" corrugated band iron furring, such furring to be stapled to bearings and the wire or metal lath to be stapled over such band iron furring.

Suspended Ceilings. To be constructed with 1½" or 2" flat bars, angles or channels as may be called for, such principals shall be spaced 4' 0" on centers, hung with flat bar or not less ¼" rod hangers every 4' 0" securely fastened with approved clips to the structural framing or through the floor construction, in the event these hangers go through the floor construction they shall be provided with 6" channels or flat bar anchors, no hanger shall be supported from the bottom flange of the tile arch. The flat bar, angle or channel runners shall be cross furred 12" on centers with ¾" steel channels, securely secured to the principals with rod clips, entire construction to be lathed with No. 18 W. M. gauge ⅜" mesh painted wire lath or No. 24 U. S. Gov. standard gauge metal lath, lath to have lapped edges at each joining and to be tied to the channel furring every 6" with 18 gauge galvanized tie wire.

Furring. All false beam or cornice furring to be constructed of ¾" channel or 1" flat bar brackets not over 2' 0" apart lined out with intermediate furring supports and anchored or toggle bolted into the construction to be made to conform to the design so as to allow for a minimum of plaster, such brackets to be covered with 18 gauge wire or 24 U. S. Gov. gauge metal painted lath secured with 18 gauge galvanized tie wire, such furring to conform to the latest and best practice as to durability of construction.

Cornice Work. All moulded beams and cornices will be screeded and run in place with moulds, with true lines and accurate mitres.

Ornamental Work. All ornamental work to be modeled by artistic modelers who will be approved by the architects. Models to be submitted for approval and no casts to be made until such models have been approved, all patterns to be gotten out by skilled mechanics with true and accurate lines.

Casts. All casts to be well made, the contractor to supply a sufficient number to meet the requirements of the job, all casts to be made in line, well and truly undercut and free from warps and other irregularities supplying all necessary shrinkers and stretchers.

Rough Casting. Lath the exterior of the house with 18 gauge wire or 24 U. S. Gov. metal painted lath stapled over 1" band iron furring scratch coat with mortar composed of 2 vols. of coarse, sharp sand 1 vol. of approved Portland cement, to which mixture add 15% of rich lime mortar, thoroughly scratched and undercut when this coat was "set," brown with mortar composed of 3 vols. sharp sand to 1 vol. Portland cement rod and straighten all surfaces and when this coat has "set" rough cast with mortar composed of 3 vols. of sharp sand or pebbles to 2 vols. Portland cement dashed on surface with a scoop or paddle to an even artistic finish.

Exterior Plastering on Wood Lath. Lath the exterior with No. 1 soft pine one-inch lath, nailed to each stud furring or bearing with not less than a 3 penny nail with full open ⅜" key space and not over seven lath to a break, plaster with 3 coats of cement plaster as called for under exterior plaster on metal lath, note the use of "hard plasters" so called are not recommended for exterior plastering.

Concrete Walls and Columns. All work on concrete walls and columns shall have such concrete well brushed with steel brushes and such concrete shall then be covered with a light coat of an approved bond cement as a bonding coat for the finish coat.

Concrete Ceilings. Shall first be washed with a solution of muriatic acid and such ceilings shall then be plastered as above.

Painted Walls. Walls that are to be coated with waterproofing shall first be scratch coated, then browned and finished.

Patching of Plaster. All patching of plaster damaged by other mechanics shall be paid for at the uniform scale of prices adopted by the Employing Plasterers' Association of Chicago, which scale of prices is set forth in the Hand Book.

Workmen's Compensation. This contractor shall insure his workmen under the provisions of the Workmen's Compensation Laws of the State of Illinois. This contractor shall also insure his liability for injury or death to "the public."

Scaffold. This contractor shall supply all necessary tools, scaffold and other appliances necessary to fulfill the requirements of the job, all scaffolding to be erected and maintained in accordance with the laws of the State relating to scaffolds.

Requirements. By Building Code in buildings of ordinary construction. At least two coats of plaster on all wood lath to ⅞" grounds.

By Union. All plain and ornamental plaster to the same contractor, the base coat of Portland cement under encaustic tile, cement base when installed independent of the floor or if 6" or more in height. All plastering regardless of the nature of the structure or of the material used.

RECOMMENDATIONS.

The use of soft pine lath, specify No. 1 white pine lath nailed to each stud, joist or bearing with 3 d. fine 16 gauge wire nails, with joints broken at least once in each seventh course or lath.

For better residence work specify one inch lath as above.

Wire or metal lath, specify No. 18 Washburn and Moen gauge wire lath ⅜" mesh, painted, or No. 24 U. S. Gov. standard metal lath painted, for better class work specify wire lath woven from galvanized strand or metal lath galvanized.

The use of wire or metal lath plastered insures slow burning construction, helps to prevent settlement cracks and bonds and ties all parts of the structure together, its use is called for in almost every building, particularly on basement ceilings to prevent or retard fire on ceilings with long span joist construction on store ceilings and under other space subject to heavy use or abuse. Its use should also be general in all better class building, in rated buildings its use throughout entitles it to better classification for insurance.

The Association recommends the use of three coat plastering. This will insure a far better class of work, a better bonding together of buildings of ordinary construction due to the use of a greater body of material. The application of the second base coat enabling one to straighten out rod and line work not possible in the use of two-coat work. Specify three-coat dry work, first coat to be a scratch coat well scratched and un-

der cut. When dry, apply a brown coat, this brown coat to be screened and rodded and when dry apply a finish coat.

The following suggestions are offered for guidance:

Sand. The use of clean, course, sharp lake sand is essential for good plastering.

Metal Lath. Should be laid with lapped edges or joinings and should be stapled to bearings every 6". No suspended ceilings should be supported from the bottom or soffit of tile.

Portland cement base coat behind encaustic tile, Opalite or kindred material should be specified under "Plastering" with one rodded coat scratched on tile or brick or a scratch and rodded brown coat scratched on metal or wire lath. We do not recommend Portland cement direct to gypsum partition or gypsum furrings.

Damp proofed, waterproofed or painted walls and ceilings are required to be given 3 coats. If a finish coat is desired, it should be so specified. All lathing plain and ornamental plastering should be specified under one heading in order to avoid divided responsibility for final results.

JURISDICTION CLAIMS.

By Plasterers' Union, any and all plastering regardless of the nature of the material, or of the structure to which it is applied, including Scagliola made under the "New Process" so called.

By Lathers' Union, all lathing, metal corner beads and all light iron furring designed, specified or used primarily as a support for lath and plaster, including "Hi Rib."

By Hodcarriers and Building Laborers' Union, all scaffolding erected for the use of plasterers.

PATCHING OF PLASTERING AFTER OTHER TRADES.

Patching of plastering after other mechanics shall not be done as a part of the contract price, and shall be paid for at the following scale of prices which have been adopted by and are recommended by the Employing Plasterers' Association of Chicago.

In accordance with wage agreements effective under the "Landis Award," and present prices of materials, the following scale of prices for patching of plastering after other mechanics and for work done upon a time and material basis, is respectfully submitted.

The prices herein include cost of insurance of men under the provisions of the Workmen's Compensation Laws of the State of Illinois.

Foreman Plasterer	$1.80 per hour
Plasterers	1.55 per hour
Foreman Lather	1.70 per hour
Lathers	1.45 per hour
Plasterer Laborer	1.15 per hour
Mortar	3.25 per bbl.
Putty	3.75 per bbl.
Neat Hard Plaster	1.30 per bag
Stucco	1.30 per bag
Metal or Wire Lath	.40 per yard
1½" Pine Lath	.75 per bunch

Owing to abnormal conditions material prices are subject to change without notice, and labor scale will be proportionately increased where bonuses are required to be paid in order to get men.

18 gauge ⅜" mesh painted wire lath or 24 gauge expanded metal painted	.40 per yard

Where seven or more men are employed in one gang on same kind of work, foreman's time will be charged continuous while work is going on; where less than seven men are employed in one gang on same kind of work, foreman's time shall be counted one hour for each seven hours of men aggregate time employed on this work, unless foreman's time is required constantly, when he shall be so paid.

CITY ORDINANCE.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 605 of the Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

605. **Wood Lathing and Plastering.)** (a) In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I: and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

Section 2. This ordinance shall be in force and effect from and after its passage and due publication.

RULES OF MEASUREMENT FOR MASON WORK

As adopted by the Builders Association of Chicago and the Associated Builders of Chicago.

Introduction.

The following rules are the expression of a custom founded in equity and prevailing in this city from its earliest days.

If to furnish and lay one thousand brick in a plain dead wall cost ten dollars, another piece of brick work of equal cost must be measured as of the same contents, even though it does not take one-fourth as many brick.

The plain dead wall, in stone as well as brick work, is taken as the standard, and more difficult, complicated ornamental and hazardous kinds of work are measured up to it, so as to make the compensation equal. To illustrate: If in one day a man can lay two thousand brick in a plain dead wall, and can lay only five hundred in a pier or arch in the same time, the cost of labor per thousand in such work is four times as much as in a wall, and is entitled to extra compensation; but instead of varying the price, the custom varies the measurement to compensate for the difference and thus endeavors to secure a uniform price per thousand for all descriptions of ordinary brickwork, instead of a different price for the execution of the various kinds of work.

This is the principle underlying the system.

If any new rules or new applications of old rules should be found in the following, we can only say in their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

The units of measurement of masons work are:

For Excavation, the cubic yard.
For Concrete, foundations, the cubic foot.
For Concrete, floors, the superficial foot.
For Dimension stone, footings, the superficial yard.
For Dimension stone, bridge masonry, the cubic foot.
For Dimension stone, surface dressing, the superficial foot extra.
For Rubblework, the cubic foot.
For Rubblework, surface dressing, the superficial foot extra.
For Brickwork, common, the thousand brick.
For Brickwork, pressed, the superficial foot.
For Tuckpointing, cleaning fronts, the superficial foot.
For Plastering, plain surfaces, the superficial yard.
For Plastering, cornices, the running and superficial foot.

Excavation.

To be measured and computed by the actual amount of material displaced—no allowance for rehandling.

Concrete. Floors—Foundations.

Measure actual contents.

Floors to be measured by the superficial foot of surface between walls.

No deductions for tile drains, nor for any pier, chimney breast, plaster or other projections of walls of ten feet or less in area.

Where concrete takes the place of stone or brickwork, figure the contents the same as you would brick or stonework.

It is not safe to do concrete work at less than 30 degrees above zero.

Dimension Stone—Footings.

Footings to be measured each course separately—no deduction for drain or other openings under walls two feet or less in width.

Bridge Masonry..

Compute actual cubic contents. .

Surface dressing of all kinds, extra.

It is not safe to do Dimension stone work at less than 25 degrees above zero.

Rubblework.

Footings to be measured by actual contents.

Note.—Footings are all such foundation courses, not exceeding sixteen inches in height each, as are wider than the body of the above.

Note.—In the following the term Corner is used for salient angles of walls, and Angle for re-entering angles.

It is not safe to do rubblework at less than 25 degrees above zero.

External Walls.

Girt building and add thickness of wall for each external angle.

Partition Walls.

Intersection of partition walls two feet or less in width to be measured double; if wider, add four cubic feet to actual contents of every intersection for each foot in length.

Beveled Corners.

For each corner of wall more or less than ninety degrees, add one foot six inches to length of wall.

Circular Walls.

For round walls add one-fifth of length of grit measure.

Pilasters, Etc.

All projections, such as chimney breast, piers connected with walls, and pilasters to be measured actual cubic contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

Piers.

Independent square piers to be measured by the same rule.

Polygon and round pier work at special rates.

Recesses, Etc.

Recesses and slots to be measured solid, and in addition thereto allow one cubic foot for every foot in height.

Arches.

Stone arches are classed as cut-stone work.

Openings.

Deduct contents of windows, doors and other openings, measuring from top of sill to spring of arch, and add two feet of wall for each jamb for every foot in height of opening.

No deductions are to be made for cut-stone trimmings and lintels.

Brickwork.

Note.—Different cities make different brick; in reality the products of no two brickyards are entirely alike in size, nor, for that matter, all bricks burned in the same kiln. The necessity of acknowledging some standard for purpose of measuration and calculation is obvious. In these rules the dimensions of a brick are understood to be 2 by 4 by 8 inches. We therefore speak of 4-inch walls, meaning the width of one brick; of 8-inch, meaning the width of two-bricks, and 12-inch walls, meaning the length of one and width of another brick, etc., although the actual width of wall will be more or less in excess of these measures.

Every superficial foot of "one-half brick (or 4-inch) wall" to be estimated at seven and one-half bricks; of "one brick (or 8-inch) wall" at fifteen bricks; of "one-half brick (or 12-inch) wall" at twenty-two and one-half bricks; of "two brick (or 16-inch) wall" at thirty bricks, etc.—increase the number of brick by seven and one-half for every additional half-brick in thickness of wall.

It is not safe to lay brick at less than 20 degrees above zero; brick laid in cement at less than 25 degrees above zero.

External Walls.

If sixteen inches thick or less girt building and add thickness of wall for each external angle.

When thicker, add to actual contents of each corner one and one-half cubic feet for every foot in height.

Allow for wall ends as for corners.

Round Walls.

Sixteen inches thick or less.

For circular walls, or radius sufficiently large to obviate the necessity of using specially molded or cut brick, add one-fifth of length to girt.

When thicker allow for sixteen inches of such wall as per above rule, and measure all in excess as straight work.

Cut or molded at special rates.

Beveled Corners.

For each corner of wall of more or less than ninety degrees, add one foot six inches to length of girt.

Partition Walls.

Sixteen inches thick or less. Intersection of partition walls (bonded together in any manner—not abutting) to be measured double.

When thicker, add one and one-half cubic feet to actual contents of every intersection for each foot in height.

Partition walls connecting with stone walls to be measured one foot into such wall.

Chimney Breasts and Pilasters.

All flues and hollows in chimneys four feet or less in area to be measured solid.

When larger deduct one-half contents of flue.

For all chimney breasts and pilasters add eight inches to face for each corner and multiply length so obtained by width (projection).

Detached chimneys in buildings and plain chimney tops to be measured solid and one-half of one cubic foot to be added for each corners of every foot in height.

Stacks.

Chimney stacks at special rates. When square, find cubic contents, measuring hollow walls solid, and deducting flue. When round or octagon, take length of diameter for side, and measure as though it was square.

Piers.

Independent piers to be measured like chimneys.

Hollow Walls.

Hollow walls to be measured solid.

Stone Fronts.

Stone fronts backed with brickwork, deduct thickness of ashlar from width and figure ordinary walls.

Gables and Wall Tops.

Whenever clipping of brick is required, add to actual contents the length of line of clipping by one foot by thickness of wall.

Cornices and Belts.

If of running courses only, multiply length by height (greatest grit in the cut) by greatest projection.

If enriched (by corbels, brackets and panels), multiply other dimensions, as given, by greatest grit length.

Ledges.

Multiply length by height by greatest projection.

Projections.

All other projections, if four inches or less, to be measured four inches; if above four inches, and not exceeding eight inches, to be measured eight inches; if above eight inches, and not exceeding twelve inches, to be measured twelve inches, etc.

Gauge Work.

Gauge work at special rates.

Openings.

Openings to be measured from top of sill to spring of arch and shortest distance between brick jambs for width.

No deductions to be made for openings two feet six inches or less in width.

One-half of contents to be deducted of openings from two feet six inches to six feet in width.

For openings of more than six feet in width allow one foot six inches by thickness of wall by height for each jamb.

Slots, Panels, Etc.

No deduction to be made for slots, chases, niches, panels or other recesses of four feet or less in width; if wider deduct contents and add two cubic feet of wall for every foot in height.

Trimmings.

No deductions in measuring brickwork for cut-stone or other trimmings, bond-blocks, timber, joists or lintels.

Arches.

Arches—not gauged.

In vaults, multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add to wall measurement.

In sewer and tunnel arches multiply length of extrados by thickness of arch.

Floor Arches and Brick Paving.

Floor arches and brick paving to be measured by the superficial foot and by rule given for measuring concrete. Deduct well-holes.

Brick-Nogging.

Measure as ordinary brickwork. Deduct full openings—no studding.

Cutting.

Cutting of joists or other holes by the piece; of slots, panels and recesses by the lineal foot.

Toothing.

When ordered by the owner or his superintendent to tooth, rack or block, in consequences of delay, of iron, stone or other material, that masonwork may connect with, such toothing, racking or blocking shall be measured as extra work, as follows: Increase girt length of such line by one-half, and multiply by one foot of thickness of wall.

Pressed Brickwork.

Measure all exposed surfaces of brick by the superficial foot.

Cut-Stone Setting.

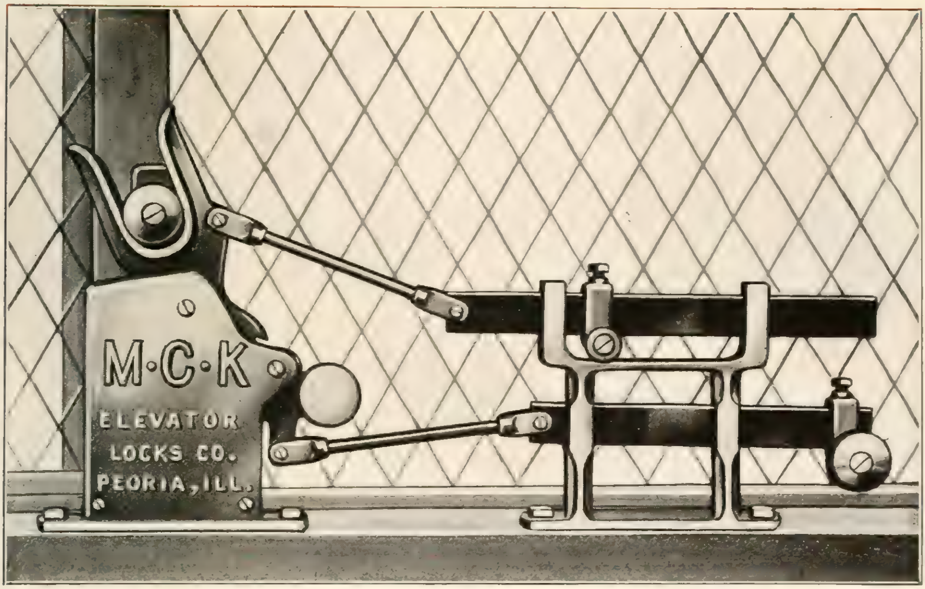
Measure vault covers, flagging, curbing and ashlar by the superficial foot, coping and belt courses by the lineal foot; all other cut stone by the cubic foot.

Tuckpointing and Cleaning.

Tuckpointing and cleaning and pointing stonework to be measured by the superficial foot of exposed surfaces.

Deadening.

Deadening to be measured by the superfical yard, floor measure, between walls—take out well holes.



M-C-K AUTOMATIC *and* PURELY MECHANICAL SAFETY LOCK

SPECIFICATIONS

All elevator shaft enclosure gates unless expressly noted otherwise shall be equipped with "M-C-K" Automatic and purely Mechanical Safety Locks as manufactured by the Elevator Locks Co., Peoria, Ill., and all locks manufactured and installed under this specification shall conform in all particulars with the Underwriters' Laboratories standard of construction and performance under test, for interlocks on elevator shaft enclosure gates.

This device shall be made of the best malleable iron and steel and all working parts shall be accurately fitted and adjusted to insure proper service.

The device shall be equipped with a — inch landing cam so installed as to absolutely control the landing of the car, within that radius.

NOTE—These landing cams are made 2", 4", 6", 8" and 10". The 2" cam allows the enclosure gate to be opened when the floor of the car is 1" above or below the level of the floor; the 4" cam allows a difference of 2" in either direction, etc., for the various lengths. The length of the cam is optional with the purchaser.

Operation—The device shall perform the following functions:

First—Mechanically lock the power and the shaft enclosure gate automatically.

Second—Lock the power while the gate is open to receive or discharge passengers.

Third—Keep the power locked until the gate is closed and securely fastened.

Fourth—Securely lock the shaft enclosure gate automatically before the power can be used to start the car.

Fifth—Lock each gate in the shaft independently of the others so that they cannot be opened until the car is stopped within the radius selected, and then only that one at which a landing has been made; said limit being controlled by the length of the landing cam forming an integral part of the device.

Sixth—Perform the above functions without the device being attached to or interfering with the motive power of the elevator.

Guarantee—The manufacturer shall guarantee each "M-C-K" Safety Lock to work properly and to replace any part or parts proving defective in workmanship or material within one year from the date of acceptance of the installation.

ELEVATOR LOCKS CO.

119 N. Washington St.
PEORIA, ILL.

WRITE FOR LIST OF BUILDINGS EQUIPPED

22 W. Monroe St.
CHICAGO, ILL.

MISCELLANEOUS AND USEFUL INFORMATION CONCERNING BUILDING ENGINEERING, TRADES AND MATERIALS.

The following pages contain tables, formulae, and miscellaneous information intended to be of assistance to architects in the preparation of plans, specifications, estimates, and the general supervision of the construction work. In order to make the classification simple and to follow a uniform system this matter is classified according to the Dewey System, see page 550, and the file or classification numbers are printed in small type at the head of each piece of matter falling under a different classification. As far as possible the names of authorities quoted are given but in some cases this has been impossible.

FILE 690.12

RULES AND FORMULAS FOR THE DESIGN OF SIMPLE WOOD BEAMS OR JOISTS.

When a beam is to be designed its length and the loads to which it is to be subjected are known, thus the maximum bending moment may be found.

The **allowable-working-strength** is assumed in accordance with engineering practice and must not be more than allowed by building laws, locally applicable. This **allowable-working-strength** is usually stated in municipal codes as a fixed number of pounds per square inch of cross sectional area, for each kind of material. This might just as well be stated in tons or any other unit of weight per square foot or any other unit of area, it being only important that whatever unit of dimension is used that the same unit shall be used both for areas, lengths and breadths.

Breadth-of-the-beam times **the-square-of-the-depth** divided by **six** equals **Bending-Moment** divided by **allowable-working-strength** per unit of area corresponding with unit of length used for stating the length and breadth of beam.

Bending-Moment (for beams uniformly loaded) equals **weight-to-be-supported-per-unit-of-length** times **the-square-of-the-total-number-of-units-of-length** divided by **eight.**

For a simple beam loaded with a single weight, the **maximum-Bending-Moment** (which is to be used in formula) equals **the-entire-load** times [(**the-length-of-the-beam**) minus (**the-distance-of-the-load-from-the-left-hand-end**)] times **the-distance-of-the-load-from-the-left-hand-end-of-the-beam** divided by **the-length-of-the-beam.**

If the load be movable **the-distance-of-load-from-left-hand-end** will be variable and the **maximum-moment** will be developed when the load is at the middle where the **maximum-Bending-Moment** is equal to **one-fourth-the-load** times **the-length-of-the-beam.** Placing the entire load on a beam at its center therefore produces the maximum strain that it is possible to produce on such beam by any position of such load.

APPLICATION OF ABOVE PRINCIPLES.

M=maximum bending moment.

S=the tensile or compressive unit stress per square inch allowable by building code or engineering practice for the material selected (See Section 539, Chicago Municipal Code, using the smallest value where there is a difference between compression and tension strength.)

l = length in inches of beam between supports.

b = breadth in inches of the beam.

d = depth in inches of the beam.

w = weight in pounds on beam including the weight of the beam itself per each inch of length.

W = total weight in pounds on beam = l w.

FOR UNIFORM LOADING.

$b = \frac{3\,w\,l^2}{4\,d^2\,S} = \frac{3\,W\,l}{4\,d^2\,S}$ = breadth of beam. $d = \sqrt{\frac{3\,w\,l^2}{4\,b\,S}} = \sqrt{\frac{3\,W\,l}{4\,b\,S}}$ = depth of beam

To find b it is necessary to assume a value for d. Also to find d it is necessary to assume a value for b. In case it is found that the value by formula is too large or too small for practical use, then assumed value must be changed so as to bring the computed value to a practical size.

SAFE STRENGTH OF CONCENTRICALLY AND ECCENTRICALLY LOADED REINFORCED CONCRETE COLUMNS

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NOTATION

A=Total core area in square inches required to take care of a direct load and a moment.
A_1=Area in square inches required to take care of concentric load only.
A_2=Area in square inches required to take care of the bending moment only.
P_1=Total concentric load on column in pounds.
P_2=Total eccentric load on column in pounds.
P=Total equivalent concentric load on column in pounds, or the concentric load which will produce the same maximum stress on the column as the eccentric load P_2.
M=Bending moment on section in inch pounds=P_2e.
C=A Constant=$2\left(\frac{y}{r}\right)^2$
E_1=Modulus of elasticity of steel.
E_2=Modulus of elasticity of concrete.
S_2=Section modulus.
I=Moment of inertia of cross section.
r=Radius of gyration of cross section.
d=Outer diameter or side of steel reinforcement in inches.
d_2=Inner diameter or side of steel reinforcement in inches.
a=Constant in moment of inertia formula $I=ad^4$.
b=Width or breadth of rectangular column in inches.
d=Core diameter in inches of hooped reinforced concrete column or side of square tied reinforced concrete column.
e=Eccentricity of load P_2 in inches.
f=Average stress in pounds per square inch on entire column section.
f_1=Allowable safe compressive stress as given by the Chicago Building Ordinance, on plain concrete.
f_2=Stress on extreme fibre in lbs. per square inch due to the moment on the section caused by the eccentric load.
k=Ratio $\frac{f_2}{f}$
m=Constant in radius of gyration formula r=md.
n_1=Constant in section modulus formula $S=n_1d^3$.
p=percentage of vertical steel in column.
p_1=percentage of hooping steel in column.
n=Ratio $\frac{E_1}{E_2}$
m_1=Constant for the area of a cross section $A=m_1d^2$.

For all reinforced concrete columns.

$$P_1=A_1f \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

when the value (f) varies with the type of the column used and with the reinforcement.

For tied square or rectangular reinforced concrete columns

$$f=f_1\left(1+\frac{p}{100}(n-1)\right) \quad \text{.. .. .. ..} (2)$$

Introducing in (2) the ordinance values (2) becomes

for 1 : 2 : 4 Concrete : $f=400\ (1+0.14p)$ (3)
for 1 : $1\frac{1}{2}$: 3 Concrete : $f=480\ (1+0.11p)$ (4)
for 1 : 1 : 2 Concrete : $f=580\ (1+0.09p)$ (5)

the result of which is given in table (1).

For reinforced concrete hooped columns the Chicago Ordinance requirements leads to the following formula:

$$f=f_1\left(1+\frac{p}{100}(n-1)\right)\left(1+2.5n\frac{p_1}{100}\right). \quad (6)$$

Introducing the ordinance values (2) becomes

for 1 : 2 : 4 concrete: $f=500\ (1+0.14p)\ (1+0.375p_1)$ . . . . (7)
for 1 : $1\frac{1}{2}$: 3 concrete: $f=600\ (1+0.11p)\ (1+0.300p_1)$ . . . . (8)
for 1 : 1 : 2 concrete: $f=725\ (1+0.09p)\ (1+0.25p_1)$ . . . . (9)

the result of which is given in table (2).

Tables (1) and (2) give the strength of columns for concentric loads only. By help of the method given in the following, they can also be used for eccentric loads:

The direct compressive stress in a short concentrically loaded column is:

$$f=\frac{P_1}{A_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

for which the cross sectional area required to take care of the concentric load is

$$A_1=\left(\frac{P_1}{f}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

When the column load is eccentric, the effect of such a load on the column is the same as the combined effect of

1.) A concentric load $P_1=P_2$
2.) A moment equal to $P_2 \cdot e=M$.

The effect of the concentric load is given by (10) and (11) and the extreme fibre stress due to a moment acting on a section of either a column or a beam, is according to the common theory of flexure:

$$f_2=\frac{M}{S_2}=\frac{P_2e}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

The safe allowable bending stress f_2 is often taken at a different value than the safe allowable compressive stress f. Calling the ratio

$$\frac{f_2}{f}=k \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

we obtain from (12)

$$kf=\frac{P_2e}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

multiply both sides of the equation with the area A_2

$$A_2kf=\frac{A_2P_2e}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad 15)$$

from which we have

$$A_2=\frac{P_2}{f}\,\frac{e}{k}\,\frac{A_2}{S_2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (16)$$

The ratio

$$\frac{A_2}{S_2}=\frac{A_2}{\frac{I}{y}}=\frac{A_2y}{I}=\frac{A_2y}{A_2r^2}=\frac{y}{r^2} \quad . \quad . \quad (17)$$

It will also be noted that $\frac{A_2}{S_2}\times d=\frac{A_2d}{S_2}=\frac{m^1d^3}{n^1d^3}=\frac{m^1}{n^1}$

This ratio is thus seen to be a ratio which is dependent upon the shape of this section only and not at all upon the area A_2. It can therefore be applied to any area whatever as long as the shape of this section is the same.

Introducing (17) in (16) and multiplying both numerator and denominator with (d) we obtain after reduction

$$A_2=\frac{P_2}{f}\,\frac{1}{k}\,2\frac{y^2}{r^2}\,\frac{e}{d} \quad . \quad . \quad . \quad . \quad . \quad . \quad (18)$$

which when constant $C=2\left(\frac{y}{r}\right)^2$ is introduced, becomes

$$A_2=\frac{P_2}{f}\,\frac{C}{k}\,\frac{e}{d} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (19)$$

The total column area required to take care of the concentric load as well as the moment is

Allowable Safe Unit Compression Stress (f) for Tied Reinforced Concrete Columns.

Table 1.

Per Cent of Vert. Steel	Table of f			Per Cent of Vert. Steel	Table of f			Per Cent of Vert. Steel	Table of f		
	n=15 1:2:4	n=12 1:1½:3	n=10 1:1:2		n=15 1:2:4	n=12 1:1½:3	n=10 1:1:2		n=15 1:2:4	n=12 1:1½:3	n=10 1:1:2
0	400	480	580	**1.4**	478	554	653	**2.4**	534	607	705
0.5	428	506	606	**1.5**	484	559	658	**2.5**	540	612	710
0.6	434	512	611	**1.6**	490	564	664	**2.6**	546	617	716
0.7	439	517	617	**1.7**	495	570	669	**2.7**	551	623	721
0.8	445	523	622	**1.8**	501	575	674	**2.8**	557	628	726
0.9	450	528	627	**1.9**	506	580	679	**2.9**	562	633	731
1.0	456	533	632	**2.0**	512	586	684	**3.0**	568	638	737
1.1	462	538	637	**2.1**	518	591	690	....	....	....	....
1.2	467	543	643	**2.2**	523	596	695	....	....	....	....
1.3	473	549	648	**2.3**	529	601	700	....	....	....	....

$$A = A_1 + A_2 \quad . . . . (20)$$

Introducing in (20) the volume found in (11) and (19) we have

$$A = \frac{P_2}{f} + \frac{P_2}{f}\frac{C}{k}\frac{e}{d} \quad . . . . (21)$$

or $$A = \frac{P_2}{f}\left(1 + \frac{C}{k}\frac{e}{d}\right) \quad . . . . . . (22)$$

and finally

$$Af = P = P_2\left(1 + \frac{C}{k}\frac{e}{d}\right) \quad . . . . (23)$$

where Af=P=the equivalent concentric load on the column which produces the same stress on the section as the eccentric load P_2.

Eccentrically loaded columns can therefore be figured same as concentrically loaded columns simply substituting the equivalent load P for the actual eccentric load P_2.

The difficulty in doing this simply consists in obtaining the value of (C). It will be seen from the above that no error whatsoever is made by obtaining the value (C) from the final column section (A) instead of from the moment section A_2. This has therefore been done, and the properties worked out for the final column section A. The properties for the reinforced concrete sections have been obtained by multiplying the steel areas by (n—1) and by finding the properties of the equivalent section in the standard manner, assuming that for round columns the steel area would form a ring of the same area as the steel reinforcing, and for square columns that the steel area would form a hollow square of the same area as the Steel reinforcing, the thickness depending upon the percentage of reinforcing in the column.

It will be too long here to give the mathematics for this. However the resulting formula for the section modulus of the column section was found to be as follows:

From (23) we obtain direct

$$\text{Ratio } \frac{P}{P_2} = \frac{1}{1 + \frac{C}{k}\frac{e}{d}} \quad . . . . . . (26)$$

which gives the ratio of the equivalent concentric load to the actual eccentric load. Tables (4) and (5) give this ratio expressed in percentages of the strength of that of a concentrically loaded column The concrete for all columns given in Tables (4) and (5) is assumed to be of a 1 : 1 : 2 mixture. For other mixtures of Concrete the percentage value will be slightly increased. Their exact value can be obtained from table (3) and formula (23).

Tables (4) and (5) show at a glance the weakening effect of applying a load with a given eccentricity. The value in this table for a concentric load will in all cases be 100. The difference between 100 and the percentage given in the tables represents the weakening effect due to the eccentricity.

It has been assumed in this analysis that the neutral axis of the section in all cases would go through the center of gravity of the section. This is in conformity with the common theory of flexure. This assumption only holds good as long as there is no actual tension in the concrete. There will be no actual tension in the concrete as long as

$$\frac{C}{k}\frac{e}{d} \leqq 1 \quad . . . . (25)$$

that is as long as the percentages given in tables (4) and (5) are above 50%. It will be noticed that in these tables there are no values below 50, which means that in all cases actual compression will exist over the entire column section.

When actual tension is developed on one

$$\text{for } \square \text{ Cols. } S = 0.1667d^3\left\{(n-1)\left(\frac{d_1{}^4 + d_2{}^4}{d_1}\right) + 1\right\} \quad . . . . (24)$$

$$\text{for } \bigcirc \text{ Cols. } S = 0.0982d^3\left\{(n-1)\left(\frac{d_1{}^4 + d_2{}^4}{d_1}\right) + 1\right\} \quad . . . . (25)$$

By help of table (3) the equivalent concentric load can be found from formula (23) for any case whatsoever. This value can be found for any value of (k). When k=1, or when the allowable bending and compression stress are equal, $\frac{C}{k}$ becomes=C.

In the Chicago Ordinance the ratio $k = \frac{700}{400} = 1.75$, and this value has therefore been used in table (3) for the value $\frac{C}{k}$

When many columns have to be figured it is somewhat cumbersome to solve (23) for each case. The author has therefore attempted to solve all cases once for all in tables (4) and (5),

side of the column section the neutral axis will move away from the center of gravity of the column section, as the concrete is unfitted to resist tensile stresses. The method of obtaining the properties of the column section under these circumstances become very complicated indeed.

It is fortunate, however, that most cases of eccentrically loaded columns which occur in actual practice will come inside of the range of tables (4) and (5).

In monolytic, reinforced concrete construction there is more or less uncertainty with respect to the eccentricity of the load. For this reason tables (4) and (5) have been made, so that they can be used for any probable eccentricity.

In monolytic reinforced concrete construction the moment found at any rigid joint will divide itself between all of the members

Table 2.

Allowable Safe Unit Compressive Stress on Core-Area of Reenforced Concrete Hooped Columns in Accordance with the Chicago Building Ordinance Requirements. Total Safe Load W = A f — Value of f. (Top Line only.) Values Obtained from Formulas 7, 8 and 9.

Percentages of Hooping Steel	Mix of Concrete	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020	1040	1060	1080	1100
0.5%	1:2 :4	0.56	0.80	1.04	1.28	1.52	1.76	2.00	2.24	2.48	2.72	2.96	3.20	3.44	3.68	3.92	4.17	4.41	4.65	4.89	5.13	5.37	5.60	5.85	6.09
	1:1½:3						0.66	0.92	1.19	1.45	1.71	1.98	2.24	2.50	2.77	3.03	3.29	3.56	3.82	4.08	4.35	4.61	4.87	5.14	5.40
	1:1 :2												0.60	0.88	1.15	1.42	1.69	1.97	2.24	2.51	2.78	3.06	3.33	3.60	3.87
0.6%	1:2 :4			0.79	1.02	1.25	1.49	1.72	1.95	2.19	2.42	2.65	2.89	3.12	3.35	3.59	3.82	4.05	4.29	4.52	4.75	4.99	5.22	5.45	5.69
	1:1½:3							0.67	0.92	1.18	1.44	1.69	1.95	2.21	2.47	2.72	2.98	3.24	3.49	3.75	4.01	4.26	4.52	4.78	5.03
	1:1 :2													0.62	0.88	1.15	1.42	1.68	1.95	2.22	2.48	2.75	3.02	3.28	3.55
0.7%	1:2 :4				0.78	1.00	1.23	1.46	1.68	1.91	2.14	2.36	2.59	2.81	3.04	3.27	3.49	3.72	3.95	4.17	4.40	4.63	4.85	5.08	5.30
	1:1½:3									0.93	1.18	1.43	1.68	1.93	2.18	2.43	2.68	2.93	3.18	3.43	3.68	3.93	4.18	4.43	4.68
	1:1 :2															0.89	1.15	1.41	1.67	1.93	2.19	2.45	2.71	2.98	3.24
0.75%	1:2 :4					0.89	1.11	1.33	1.55	1.78	2.00	2.22	2.45	2.67	2.89	3.12	3.34	3.56	3.78	4.01	4.23	4.45	4.68	4.90	5.12
	1:1½:3									0.80	1.05	1.30	1.55	1.79	2.04	2.29	2.54	2.78	3.03	3.28	3.53	3.77	4.02	4.27	4.51
	1:1 :2															0.76	1.02	1.28	1.54	1.79	2.05	2.31	2.57	2.83	3.09
0.8%	1:2 :4						0.99	1.21	1.43	1.65	1.87	2.09	2.31	2.53	2.75	2.97	3.19	3.41	3.63	3.85	4.07	4.29	4.51	4.73	4.95
	1:1½:3										0.93	1.17	1.42	1.66	1.91	2.15	2.39	2.64	2.88	3.13	3.37	3.62	3.86	4.11	4.35
	1:1 :2																0.89	1.15	1.40	1.66	1.92	2.17	2.43	2.68	2.94
0.9%	1:2 :4							0.97	1.19	1.40	1.62	1.83	2.04	2.26	2.47	2.68	2.90	3.11	3.32	3.54	3.75	3.97	4.18	4.39	4.61
	1:1½:3											0.93	1.17	1.41	1.65	1.88	2.12	2.36	2.60	2.84	3.08	3.32	3.56	3.79	4.03
	1:1 :2																	0.90	1.15	1.40	1.65	1.90	2.15	2.40	2.65
1.0%	1:2 :4									1.17	1.38	1.58	1.79	2.00	2.21	2.42	2.62	2.83	3.04	3.25	3.45	3.66	3.87	4.08	4.29
	1:1½:3													1.17	1.40	1.63	1.86	2.10	2.33	2.56	2.80	3.03	3.26	3.50	3.73
	1:1 :2																			1.15	1.39	1.64	1.89	2.13	2.38
1.1%	1:2 :4										1.15	1.35	1.55	1.76	1.96	2.16	2.36	2.57	2.77	2.97	3.17	3.38	3.58	3.78	3.98
	1:1½:3														1.16	1.39	1.62	1.85	2.07	2.30	2.53	2.76	2.98	3.21	3.44
	1:1 :2																				1.15	1.39	1.63	1.87	2.11
1.2%	1:2 :4												1.33	1.53	1.72	1.92	2.11	2.32	2.51	2.71	2.91	3.10	3.30	3.50	3.70
	1:1½:3																1.38	1.60	1.83	2.05	2.27	2.50	2.72	2.94	3.16
	1:1 :2																						1.39	1.62	1.86
1.25%	1:2 :4													1.42	1.61	1.81	2.00	2.20	2.39	2.59	2.78	2.97	3.17	3.36	3.56
	1:1½:3																1.27	1.49	1.71	1.93	2.15	2.37	2.59	2.81	3.03
	1:1 :2																						1.27	1.50	1.73
1.3%	1:2 :4													1.31	1.50	1.69	1.88	2.08	2.27	2.46	2.65	2.84	3.04	3.23	3.42
	1:1½:3																	1.37	1.59	1.81	2.03	2.25	2.46	2.68	2.90
	1:1 :2																							1.38	1.61
1.4%	1:2 :4															1.48	1.66	1.85	2.04	2.22	2.41	2.60	2.79	2.97	3.16
	1:1½:3																			1.58	1.79	2.01	2.22	2.43	2.65
	1:1 :2																								
1.5%	1:2 :4																	1.63	1.82	2.00	2.18	2.37	2.55	2.73	2.91
	1:1½:3																				1.57	1.78	1.99	2.19	2.40
	1:1 :2																								

NOTE—Figures below top line give percentages of vertical steel in hooped reinforced concrete columns only.

Allowable Safe Unit Compressive Stress on Core-Area of Reenforced Concrete Hooped Columns. (Continued.)

Percentages of Hooping Steel	Mix of Concrete	1120	1140	1160	1180	1200	1220	1240	1260	1280	1300	1320	1340	1360	1380	1400	1420	1440	1460	1480	1500	1540	1580	1620	1660
0.5%	1:2 :4	6.33	6.57	6.81	7.05	7.29	7.53	7.77	8.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	1:1½:3	5.67	5.93	6.19	6.46	6.72	6.98	7.25	7.51	7.77	8.04	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	1:1 :2	4.15	4.42	4.69	4.96	5.24	5.51	5.78	6.05	6.33	6.60	6.87	7.14	7.42	7.69	7.96	....	....	....	....	....	....	....	....	....
0.6%	1:2 :4	5.92	6.15	6.38	6.62	6.85	7.08	7.32	7.55	7.78	8.02	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	1:1½:3	5.29	5.55	5.80	6.06	6.32	6.57	6.83	7.09	7.34	7.60	7.86	....	....	....	....	....	....	....	....	....	....	....	....	....
	1:1 :2	3.81	4.08	4.35	4.61	4.88	5.15	5.41	5.68	5.95	6.21	6.48	6.75	7.01	7.28	7.55	7.81	....	....	....	....	....	....	....	....
0.7%	1:2 :4	5.53	5.76	5.98	6.21	6.44	6.66	6.89	7.11	7.34	7.57	7.79	8.02	....	....	....	....	....	....	....	....	....	....	....	....
	1:1½:3	4.93	5.18	5.43	5.68	5.94	6.19	6.44	6.69	6.91	7.19	7.44	7.69	7.94	....	....	....	....	....	....	....	....	....	....	....
	1:1 :2	3.50	3.76	4.02	4.28	4.54	4.80	5.06	5.32	5.58	5.85	6.11	6.37	6.63	6.89	7.15	7.41	7.67	7.93	....	....	....	....	....	....
0.75%	1:2 :4	5.35	5.57	5.79	6.01	6.24	6.46	6.68	6.91	7.13	7.35	7.58	7.80	8.02	....	....	....	....	....	....	....	....	....	....	....
	1:1½:3	4.76	5.01	5.26	5.50	5.75	6.00	6.25	6.49	6.74	6.99	7.24	7.48	7.73	7.98	....	....	....	....	....	....	....	....	....	....
	1:1 :2	3.34	3.60	3.86	4.12	4.38	4.63	4.89	5.15	5.41	5.67	5.92	6.18	6.44	6.70	6.96	7.21	7.47	7.73	7.99	....	....	....	....	....
0.8%	1:2 :4	5.16	5.38	5.60	5.82	6.04	6.26	6.48	6.70	6.92	7.14	7.36	7.58	7.80	8.02	....	....	....	....	....	....	....	....	....	....
	1:1½:3	4.59	4.84	5.08	5.33	5.57	5.82	6.06	6.31	6.55	6.79	7.04	7.28	7.53	7.87	8.02	....	....	....	....	....	....	....	....	....
	1:1 :2	3.19	3.45	3.70	3.96	4.21	4.47	4.73	4.98	5.24	5.49	5.75	6.00	6.26	6.51	6.77	7.02	7.28	7.54	7.79	....	....	....	....	....
0.9%	1:2 :4	4.82	5.03	5.25	5.46	5.67	5.89	6.10	6.32	6.53	6.74	6.96	7.17	7.38	7.60	7.81	8.02	....	....	....	....	....	....	....	....
	1:1½:3	4.27	4.51	4.75	4.99	5.23	5.46	5.70	5.94	6.18	6.42	6.66	6.90	7.13	7.37	7.61	7.85	....	....	....	....	....	....	....	....
	1:1 :2	2.90	3.15	3.40	3.65	3.90	4.15	4.40	4.65	4.90	5.15	5.40	5.65	5.90	6.15	6.40	6.65	6.90	7.16	7.41	7.66	....	....	....	....
1.0%	1:2 :4	4.49	4.70	4.91	5.12	5.33	5.53	5.74	5.95	6.16	6.36	6.57	6.78	6.99	7.20	7.40	7.61	7.82	8.03	....	....	....	....	....	....
	1:1½:2	3.96	4.20	4.43	4.66	4.90	5.13	5.36	5.59	5.83	6.06	6.29	6.53	6.76	6.99	7.23	7.46	7.69	7.93	....	....	....	....	....	....
	1:1 :2	2.62	2.87	3.11	3.36	3.60	3.85	4.09	4.34	4.58	4.83	5.07	5.32	5.56	5.81	6.05	6.30	6.54	6.79	7.03	7.28	7.77	....	....	....
1.1%	1:2 :4	4.18	4.39	4.59	4.79	4.99	5.20	5.40	5.60	5.80	6.00	6.21	6.41	6.61	6.81	7.02	7.22	7.42	7.62	7.83	8.03	....	....	....	....
	1:1½:3	3.67	3.90	4.12	4.35	4.58	4.81	5.04	5.26	5.49	5.72	5.95	6.17	6.40	6.63	6.86	7.09	7.31	7.54	7.77	8.00	....	....	....	....
	1:1 :2	2.35	2.59	2.83	3.07	3.31	3.55	3.79	4.03	4.27	4.52	4.76	5.00	5.24	5.48	5.72	5.96	6.20	6.44	6.68	6.92	7.40	7.88	....	....
1.2%	1:2 :4	3.89	4.09	4.29	4.48	4.68	4.88	5.07	5.27	5.47	5.67	5.86	6.06	6.26	6.45	6.65	6.85	7.05	7.24	7.44	7.64	....	....	....	....
	1:1½:3	3.39	3.61	3.83	4.06	4.28	4.50	4.72	4.95	5.17	5.39	5.62	5.84	6.06	6.28	6.51	6.73	6.95	7.17	7.40	7.62	....	....	....	....
	1:1 :2	2.09	2.33	2.56	2.80	3.04	3.27	3.51	3.74	3.98	4.21	4.45	4.69	4.92	5.16	5.39	5.63	5.87	6.10	6.34	6.57	7.04	7.52	7.99	....
1.25%	1:2 :4	3.75	3.95	4.14	4.34	4.53	4.72	4.92	5.11	5.31	5.50	5.70	5.89	6.09	6.28	6.47	6.67	6.86	7.06	7.25	7.45	7.84	....	....	....
	1:1½:3	3.25	3.47	3.69	3.91	4.13	4.35	4.57	4.79	5.01	5.23	5.45	5.67	5.90	6.12	6.34	6.56	6.78	7.00	7.22	7.44	7.88	....	....	....
	1:1 :2	1.97	2.20	2.43	2.67	2.90	3.13	3.37	3.60	3.83	4.07	4.30	4.53	4.77	5.00	5.23	5.47	5.70	5.93	6.17	6.40	6.87	7.33	7.80	....
1.3%	1:2 :4	3.61	3.80	4.00	4.19	4.38	4.57	4.76	4.96	5.15	5.34	5.53	5.72	5.92	6.11	6.30	6.49	6.68	6.88	7.07	7.26	7.64	....	....	....
	1:1½:3	3.12	3.34	3.55	3.77	3.99	4.21	4.43	4.64	4.86	5.08	5.30	5.52	5.73	5.95	6.17	6.39	6.61	6.82	7.04	7.26	7.70	....	....	....
	1:1 :2	1.84	2.07	2.31	2.54	2.77	3.00	3.23	3.46	3.69	3.93	4.16	4.39	4.62	4.85	5.08	5.31	5.54	5.78	6.01	6.21	6.70	7.16	7.63	....
1.4%	1:2 :4	3.35	3.54	3.72	3.91	4.10	4.29	4.47	4.66	4.85	5.04	5.22	5.41	5.60	5.78	5.97	6.16	6.35	6.53	6.72	6.91	7.28	7.66	....	....
	1:1½:3	2.86	3.07	3.29	3.50	3.71	3.93	4.14	4.35	4.57	4.78	4.99	5.21	5.42	5.63	5.85	6.06	6.27	6.49	6.70	6.91	7.34	7.77	....	....
	1:1 :2	1.60	1.83	2.06	2.29	2.51	2.74	2.97	3.19	3.42	3.65	3.88	4.10	4.33	4.56	4.78	5.01	5.24	5.46	5.69	5.92	6.37	6.83	7.28	7.74
1.5%	1:2 :4	3.10	3.28	3.46	3.65	3.83	4.01	4.19	4.38	4.56	4.74	4.93	5.11	5.29	5.47	5.66	5.84	6.02	6.21	6.39	6.57	6.94	7.30	7.67	....
	1:1½:3	2.61	2.82	3.03	3.24	3.45	3.66	3.87	4.08	4.28	4.49	4.70	4.91	5.12	5.33	5.54	5.75	5.96	6.16	6.37	6.58	7.00	7.42	7.84	....
	1:1 :2	1.37	1.60	1.82	2.04	2.26	2.49	2.71	2.93	3.16	3.38	3.60	3.82	4.05	4.27	4.49	4.72	4.94	5.16	5.39	5.61	6.05	6.50	6.95	7.39

Properties of Reinforced Concrete Column Sections. **Table 3.**

Round Hooped Columns

% of V. Steel	Mix Concrete	I: $I = Ad^4$	S_2: $s_2 = nd^3$	r: $r = md$	C: $C = \frac{Ad}{s}$	$\frac{C}{k} = \frac{700}{400} = 1.75$
		a	n	m	C	C/k
Plain	1:2 :4	0.0491	0.0982	0.25	8.00	4.571-
	1:1½:3	0.0491	0.0982	0.25	8.00	4.571
	1:1 :2	0.0491	0.0982	0.25	8.00	4.571-
0.5	1:2 :4	0.0553	0.1106	0.2655	7.10	4.06
	1:1½:3	0.0539	0.1079	0.2621	7.27	4.15
	1:1 :2	0.0530	0.1061	0.2598	7.40	4.23
1.0	1:2 :4	0.0615	0.1231	0.2798	6.38	3.65
	1:1½:3	0.0588	0.1176	0.2737	6.68	3.82
	1:1 :2	0.0570	0.1141	0.2694	6.88	3.93-
1.5	1:2 :4	0.0676	0.1353	0.2936	5.81	3.32
	1:1½:3	0.0636	0.1272	0.2846	6.31	3.60
	1:1 :2	0.0610	0.1221	0.2787	6.43	3.67
2.0	1:2 :4	0.0740	0.1480	0.3069	5.30	3.06
	1:1½:3	0.0686	0.1373	0.2956	5.72	3.26
	1:1 :2	0.0651	0.1302	0.2881	6.03	3.44
2.5	1:2 :4	0.0796	0.1593	0.3183	4.93	2.81
	1:1½:3	0.0731	0.1462	0.3051	5.37	3.07
	1:1 :2	0.0687	0.1375	0.2958	5.71	3.26
3.0	1:2 :4	0.0857	0.1715	0.3305	4.58	2.62
	1:1½:3	0.0779	0.1558	0.3150	5.04	2.88
	1:1 :2	0.0726	0.1453	0.3041	5.41	3.09
4.0	1:2 :4	0.0980	0.1960	0.3533	4.01	2.29
	1:1½:3	0.0875	0.1750	0.3338	4.49	2.57
	1:1 :2	0.0805	0.1611	0.3202	4.87	2.78-
5.0	1:2 :4	0.1101	0.2202	0.3747	3.57	2.04
	1:1½:3	0.0970	0.1941	0.3514	4.05	2.31
	1:1 :2	0.0883	0.1766	0.3353	4.45	2.54
6.0	1:2 :4	0.1222	0.2445	0.3946	3.21	1.83
	1:1½:3	0.1065	0.2130	0.3684	3.69	2.11
	1:1 :2	0.0960	0.1921	0.3496	4.08	2.33
7.0	1:2 :4	0.1336	0.2673	0.4125	2.94	1.68
	1:1½:3	0.1155	0.2311	0.3835	3.40	1.94
	1:1 :2	0.1034	0.2069	0.3630	3.80	2.17
8.0	1:2 :4	0.1457	0.2914	0.4308	2.70	1.54
	1:1½:3	0.1250	0.2500	0.3990	3.14	1.795
	1:1 :2	0.1112	0.2224	0.3763	3.53	2.018-

Square Tied Columns

% V. Steel	Mix	Axis	$I = Ad^4$ Val. of a	$s = nd^3$ Val. of n	$r = md$ Val. of m	$C = \frac{Ad}{s}$	$\frac{C}{k} = \frac{700}{400} = 1.75$
Plain	All	□	0.0833	0.1667	0.2886	6.000	3.43
Plain	All	dia.	0.0833	0.1179	0.2886	8.482	4.85
0.5	1:2 :4	□	0.0938	0.1876	0.3063	5.330	3.05
		dia.	0.0938	0.1326	0.3063	7.541	4.31
	1:1½:3	□	0.0915	0.1831	0.3025	5.461	3.12
		dia.	0.0915	0.1295	0.3025	7.722	4.41
	1:1 :2	□	0.0900	0.1801	0.3000	5.552	3.17
		dia.	0.0900	0.1274	0.3000	7.849	4.48
1.0	1:2 :4	□	0.1042	0.2085	0.3228	4.796	2.74
		dia.	0.1042	0.1475	0.3228	6.780	3.87
	1:1½:3	□	0.0997	0.1995	0.3158	5.013	2.86
		dia.	0.0997	0.1412	0.3158	7.082	4.05
	1:1 :2	□	0.0968	0.1936	0.3112	5.165	2.95-
		dia.	0.0968	0.1369	0.3112	7.305	4.17
1.5	1:2 :4	□	0.1148	0.2296	0.3388	4.355	2.49
		dia.	0.1148	0.1622	0.3388	6.165	3.52
	1:1½:3	□	0.1080	0.2161	0.3286	4.627	2.64
		dia.	0.1080	0.1528	0.3286	6.544	3.74
	1:1 :2	□	0.1035	0.2071	0.3217	4.829	2.76
		dia.	0.1035	0.1464	0.3217	6.831	3.90
2.0	1:2 :4	□	0.1256	0.2512	0.3544	3.981	2.28
		dia.	0.1256	0.1775	0.3544	5.634	3.22
	1:1½:3	□	0.1165	0.2331	0.3413	4.290	2.45
		dia.	0.1165	0.1648	0.3413	6.068	3.47
	1:1 :2	□	0.1105	0.2210	0.3324	4.525	2.59
		dia.	0.1105	0.1563	0.3324	6.398	3.66
2.5	1:2 :4	□	0.1352	0.2704	0.3677	3.698	2.21
		dia.	0.1352	0.1911	0.3677	5.233	2.99
	1:1½:3	□	0.1240	0.2481	0.3521	4.031	2.30
		dia.	0.1240	0.1752	0.3521	5.708	3.26
	1:1 :2	□	0.1166	0.2333	0.3415	4.286	2.45
		dia.	0.1166	0.1650	0.3415	6.061	3.46
3.0	1:2 :4	□	0.1455	0.2910	0.3814	3.436	1.97
		dia.	0.1455	0.2056	0.3814	4.846	2.78
	1:1½:3	□	0.1322	0.2644	0.3636	3.782	2.16
		dia.	0.1322	0.1870	0.3636	5.348	3.05
	1:1 :2	□	0.1233	0.2466	0.3511	4.055	2.32-
		dia.	0.1233	0.1742	0.3511	5.741	3.28

meeting at the joint in proportion to their relative rigidities. When the length of the members are the same, the moment of inertia of the cross section will be a direct measure for the rigidity of the member.

Table (3) gives the moment of inertia of column sections. Whenever the moment of inertia of the floor girders are known, the question of how much of the moment each column and each girder will take care of can be determined.

In monolytic reinforced concrete construction the moment at any joint may be caused by any one or all of the following causes:

Strength of Eccentrically Loaded Reinforced Concrete Columns in Percentages of the Strength of Concentrically Loaded Columns. Round Hooped Columns of 1:1:2 Mix. For All Percentages of Hooping Reinforcing. **Table 4.**

Core Diam.	Ecc.	Offset	Plain	1%	4%	8%	Core Diam.	Ecc.	Offset	Plain	1%	4%	8%
	¼″	1″	87.5	89.0	92.0	94.1		½″	2″	88.7	90.2	92.9	94.1
	½″	2″	77.8	80.3	85.2	88.8		1″	4″	79.7	82.1	86.7	89.9
8″	1″	4″	63.6	67.1	74.2	79.9	**18″**	2″	......	66.3	69.6	76.4	81.7
	2″	......	......	50.5	59.0	66.5		3″	......	56.8	60.5	68.3	74.9
	3″	......	......	......	......	56.9		4″	......	......	53.4	61.8	69.0
	¼″	1″	88.7	90.2	92.9	94.7		½″	2″	89.8	91.1	93.5	95.2
	½″	2″	79.7	82.1	86.7	89.9		1″	4″	81.4	83.6	87.8	90.8
9″	1″	4″	66.3	69.6	76.4	81.7	**20″**	2″	......	68.6	71.8	78.2	83.2
	2″	......	......	53.4	61.8	69.0		3″	......	59.3	62.9	70.6	76.7
	3″	......	......	......	51.9	59.8		4″	......	52.2	56.0	64.3	71.2
	¼″	1″	89.8	91.1	93.5	95.2		½″	2″	90.6	91.8	94.1	95.6
	½″	2″	81.4	83.6	87.8	90.8		1″	4″	82.8	84.9	88.8	91.6
10″	1″	4″	68.6	71.8	78.2	83.2	**22″**	2″		70.6	73.7	79.8	84.5
	2″	......	52.2	56.0	64.3	71.2		3″	......	61.6	65.1	72.6	78.4
	3″	......	......	......	54.5	62.3		4″	......	54.6	58.3	66.4	73.2
	¼″	1″	90.6	91.8	94.1	95.6		½″	2″	91.2	92.4	94.5	96.0
	½″	2″	82.8	84.9	88.8	91.6		1″	4″	83.8	86.0	89.6	92.3
11″	1″	4″	70.6	73.7	79.8	84.5	**24″**	2″	......	72.4	75.4	81.2	85.6
	2″	......	54.6	58.3	66.4	73.2		3″	......	63.6	67.1	74.2	79.9
	3″	......	......	......	56.9	64.5		4″	......	56.8	60.5	68.3	74.9
	½″	2″	84.0	86.0	89.6	92.3		½″	2″	92.4	93.5	95.2	96.5
	1″	4″	72.4	75.4	81.2	85.6		1″	4″	86.0	87.7	91.0	93.3
12″	2″	......	56.8	60.5	68.3	74.9	**28″**	2″	......	75.4	78.1	83.4	87.4
	3″	......	......	50.5	59.0	66.5		3″	......	62.9	70.4	77.0	82.2
	4″	......	......	......	51.9	59.8		4″	......	60.5	64.0	71.6	77.6
	½″	2″	86.0	87.7	91.0	93.3		½″	2″	93.4	94.3	95.9	97.0
	1″	4″	75.4	78.1	83.4	87.4		1″	4″	87.5	89.0	92.0	94.1
14″	2″.	......	60.5	64.0	71.6	77.6	**32″**	2″	......	77.8	80.3	85.2	88.8
	3″	......	50.5	54.3	62.7	69.8		3″	......	70.0	73.0	79.3	84.1
	4″	......	......	......	55.7	63.5		4″	......	63.6	67.1	74.2	79.9
	½″	2″	87.5	89.0	92.0	94.1		½″	2″	94.0	94.8	96.2	97.3
	1″	4″	77.8	80.3	85.2	88.8		1″	4″	88.7	90.2	92.9	94.7
16″	2″	......	63.6	67.1	74.2	79.9	**36″**	2″	......	79.7	82.1	86.7	89.9
	3″	......	53.8	57.5	65.7	72.6		3″	......	72.4	75.4	81.2	85.6
	4″	......	......	50.5	59.0	66.5		4″	......	66.3	69.6	76.4	81.7

(1) By the column above being eccentric with respect to the column below.

(2) By the unbalanced moments at the face of the column in beams or girders framing into the columns from opposite sides.

(3) By the beam or girder being placed eccentric with respect to the column axis.

The moments caused by the second and third of these items may or may not be of the same sign as that of the eccentric load from the column above.

Roughly speaking, we would err on the safe side by assuming that the total moment will be divided equally between the column above and the column below.

When the columns in two consecutive stories are flush on one side and are offset on the other side, as is often the case with wall columns the eccentricity of the axis of the two columns will be ½ of the offset. If then each column takes half the moment, the eccentricity for each column will be ¼ of the offset. This assumption although a rough one, has been made in tables (4) and (5) in order to assist in getting a line on the real eccentricity for the case in hand. Of course on this basis the maximum eccen-

Strength of Eccentrically Loaded Reinforced Concrete Columns in Percentages of the Strength of Concentrically Loaded Columns. **Table 5.**

Axis Parallel with Side of Column

Core Diam.	Ecc.	Offset One Side	Square Tied Columns, 1:1:2 Mix Plain	1%	2%	3%
	1/4"	1"	90.3	91.6	92.5	92.3
	1/2"	2"	82.4	84.5	86.1	87.3
8"	1"	4"	70.0	73.0	75.6	77.5
	2"	.....	53.8	57.5	60.8	63.3
	3"	.....	.....	.....	50.8	53.5
	1/4"	1"	91.3	92.4	93.3	94.0
	1/2"	2"	84.0	85.9	87.4	88.6
9"	1"	4"	72.4	75.3	77.7	79.5
	2"	.....	56.8	60.4	63.5	66.0
	3"	.....	.....	50.4	53.7	56.4
	1/4"	1"	92.1	93.1	93.9	94.5
	1/2"	2"	85.4	87.1	88.6	89.6
10"	1"	4"	74.5	77.2	79.4	81.2
	2"	.....	59.3	62.9	65.9	68.3
	3"	.....	.....	53.0	56.3	59.0
	1/4"	1"	92.8	93.7	94.4	95.0
	1/2"	2"	86.5	88.2	89.5	90.5
11"	1"	4"	76.2	78.9	81.0	82.6
	2"	.....	61.6	65.1	68.0	70.4
	3"	.....	51.7	55.4	58.7	61.2
	1/2"	2"	87.5	89.0	90.3	91.2
	1"	4"	77.8	80.3	82.3	83.8
12"	2"	.....	63.6	67.0	69.9	72.2
	3"	.....	53.8	57.5	60.8	63.3
	4"	.....	.....	50.4	53.7	56.4
	1/2"	2"	89.1	90.5	91.6	92.3
	1"	4"	80.3	82.6	84.4	85.8
14"	2"	.....	67.1	70.3	73.0	75.1
	3"	.....	57.6	61.2	64.4	66.8
	4"	.....	50.5	54.2	57.5	60.2
	1/2"	2"	90.3	91.6	92.5	92.3
	1"	4"	82.4	84.5	86.1	87.3
16"	2"	.....	70.0	73.0	75.6	77.5
	3"	.....	60.9	64.4	67.3	69.7
	4"	.....	53.8	57.5	60.7	63.3

Axis Taken Diagonally with Column

Core Diam.	Ecc.	Offset 2 Con. Sides	Square Tied Columns, 1:1:2 Mix Plain	1%	2%	3%
	1/4"	1"	86.9	88.5	89.8	90.7
	1/2"	2"	76.8	79.4	81.4	83.0
8"	1"	4"	62.3	65.7	68.6	70.9
	2"	.....	.....	.....	52.2	54.9
	3"	.....	.....	.....	.....	.....
	1/4"	1"	88.1	89.6	90.7	91.7
	1/2"	2"	78.8	81.2	83.1	84.6
9"	1"	4"	65.0	68.3	71.1	73.3
	2"	.....	.....	51.9	55.1	57.8
	3"	.....	.....	.....	.....	.....
	1/4"	1"	89.2	90.6	91.6	92.4
	1/2"	2"	80.5	82.8	84.5	85.9
10"	1"	4"	67.3	70.6	73.2	75.3
	2"	.....	50.8	54.5	57.7	60.4
	3"	.....	.....	.....	.....	50.4
	1/4"	1"	90.9	91.3	92.3	93.0
	1/2"	2"	82.0	84.0	85.8	87.0
11"	1"	4"	69.4	72.5	75.0	77.0
	2"	.....	53.2	56.9	60.0	62.7
	3"	.....	.....	.....	50.0	52.8
	1/2"	2"	83.2	85.2	86.7	88.0
	1"	4"	71.2	74.2	76.6	78.6
12"	2"	.....	55.3	59.0	62.1	64.6
	3"	.....	.....	.....	52.2	54.9
	4"	.....	.....	.....	.....	.....
	1/2"	2"	85.3	87.0	88.4	89.5
	1"	4"	74.3	77.0	79.2	81.0
14"	2"	.....	59.1	62.7	65.6	68.1
	3"	.....	.....	52.8	56.0	58.7
	4"	.....	.....	.....	.....	51.6
	1/2"	2"	86.8	88.5	89.8	90.7
	1"	4"	76.7	79.4	81.4	83.0
16"	2"	.....	62.3	65.7	68.6	70.9
	3"	.....	52.4	56.1	59.3	61.9
	4"	.....	.....	.....	52.2	54.9

tricity exists at one or both ends of the column and the eccentricity at any point along the length of the column can easily be determined.

Reviewing the results in table (2), which represents the safe allowable unit compressive stresses allowed by the Chicago Building Ordinance, it will be observed that for the highest percentages of steel practically the same strength is obtained for the different mixtures of concrete. When the ordinance was drawn up the author pointed out that the empirical rule of the Chicago Ordinance allowed a lean mixture to obtain a greater strength than a rich mixture of concrete. The committee then made the rule that no leaner mixure than 1:2:4 was to be allowed in reinforced concrete columns. Table (2) shows that this rule did not take care of the matter completely. The commitee should

Strength of Eccentrically Loaded Reinforced Concrete Columns in Percentages of the Strength of Concentrically Loaded Columns. **Table 5.**

Axis Parallel with Side of Column

Core Diam.	Ecc.	Offset One Side	Square Tied Columns, 1:1:2 Mix Plain	1%	2%	3%
18″	½″	2″	91.3	92.4	93.3	94.0
	1″	4″	84.0	85.9	87.4	88.6
	2″	......	72.4	75.3	77.7	79.5
	3″	......	63.6	67.0	69.9	72.2
	4″	......	56.8	60.4	63.5	66.0
20″	½″	2″	92.1	93.1	93.9	94.5
	1″	4″	85.4	87.1	88.6	89.6
	2″	......	74.5	77.2	79.4	81.2
	3″	......	66.1	69.3	71.5	74.2
	4″	......	59.3	62.9	65.9	68.3
22″	½″	2″	92.8	93.7	94.4	95.0
	1″	4″	86.5	88.2	89.4	90.5
	2″	......	76.2	78.9	81.0	82.6
	3″	......	68.1	71.3	73.9	76.0
	4″	......	61.6	65.1	68.0	70.3
24″	½″	2″	93.3	94.2	94.9	95.4
	1″	4″	87.5	89.0	90.3	91.2
	2″	......	77.8	80.3	82.3	83.8
	3″	......	70.0	73.0	75.6	77.5
	4″	......	63.6	67.0	69.9	72.2
28″	½″	2″	94.3	95.0	95.6	96.1
	1″	4″	89.1	90.5	91.5	92.3
	2″	......	80.3	82.6	84.4	85.8
	3″	......	73.2	76.0	78.3	80.1
	4″	......	67.1	70.3	73.0	75.1
32″	½″	2″	95.0	95.6	96.2	96.5
	1″	4″	90.3	91.6	92.5	93.3
	2″	......	82.4	84.5	86.1	87.3
	3″	......	75.7	78.4	80.5	82.2
	4″	......	70.0	73.0	75.6	77.5
36″	½″	2″	95.4	96.1	96.5	96.9
	1″	4″	91.3	92.4	93.3	94.0
	2″	......	84.0	85.9	87.4	88.6
	3″	......	77.8	80.3	82.2	83.8
	4″	......	72.4	75.3	77.7	79.5

Axis Taken Diagonally with Column

Core Diam.	Ecc.	Offset 2 Con. Sides	Square Tied Columns, 1:1:2 Mix Plain	1%	2%	3%
18″	½″	2″	88.1	89.6	90.7	91.7
	1″	4″	78.8	81.2	83.1	84.6
	2″	......	65.0	68.3	71.1	73.3
	3″	......	55.3	59.0	62.1	64.6
	4″	......	......	51.9	55.1	57.8
20″	½″	2″	89.2	90.6	91.6	92.4
	1″	4″	80.5	82.8	84.5	85.9
	2″	......	67.3	70.6	73.2	75.3
	3″	......	57.9	61.5	64.5	67.0
	4″	......	50.8	54.5	57.7	60.4
22″	½″	2″	90.1	91.3	92.3	93.0
	1″	4″	82.0	84.0	85.8	87.0
	2″	......	69.4	72.5	75.0	77.0
	3″	......	60.2	63.7	66.7	69.1
	4″	......	53.2	56.9	60.0	62.7
24″	½″	2″	90.8	92.0	92.9	93.5
	1″	4″	83.2	85.2	86.7	88.0
	2″	......	71.2	74.2	76.6	85.3
	3″	......	62.3	65.7	68.6	70.9
	4″	......	55.3	59.0	62.1	64.6
28″	½″	2″	92.0	93.0	93.9	94.4
	1″	4″	85.3	87.0	88.4	89.5
	2″	......	74.3	77.0	79.2	81.0
	3″	......	65.8	69.1	71.8	74.0
	4″	......	59.1	62.7	65.6	68.1
32″	½″	2″	92.9	93.9	94.6	95.1
	1″	4″	86.8	88.5	89.8	90.7
	2″	......	76.7	79.4	81.4	83.0
	3″	......	68.7	71.9	74.5	76.5
	4″	......	62.2	65.7	68.6	70.9
36″	½″	2″	93.7	94.5	95.1	95.6
	1″	4″	88.1	89.6	90.7	91.3
	2″	......	78.8	81.2	82.9	84.6
	3″	......	71.2	74.2	76.6	78.6
	4″	......	65.0	68.3	71.1	73.3

also have established a maximum limit of stress for each mixture of concrete, as for example:

1100 lbs. for 1 : 2 : 4 concrete
1300 lbs. for 1 : 1½ : 3 concrete and
1630 lbs. for 1 : 1 : 2 concrete.

Unfortunately the ordinance allows this highest stress for the 1:2:4 concrete. However, any competent engineer, who is alive to the fitness of things will not use such high stresses in his own work. This shows that even the rules given in the ordinance may lead to unscientific design when used without judgment. Even when these recommendations are lived up to the Chicago Ordinance requirements for reinforced concrete columns are not too conservative as many would lead us to believe, as there are still too many uncertainties both in the design, material and workmanship for such columns.

TABLES OF WORKING STRESSES IN ORDINARY STRUCTURAL DESIGN

By BENJAMIN E. WINSLOW, M. W. S. E.

The tables and data given on pages 358, 359 and 360 are extracts from articles published by Mr. Winslow in "The Technograph" (Editor)

Ultimate and Safe Strength of Wood in Pounds Per Square Inch

MATERIAL	Extreme Fiber Stresses			Compression with the Grain			Compression Across the Grain			Modulus of Elasticity		Weight per Cubic Foot	
	Ultimate		Safe	Ultimate		Safe	Ultimate		Safe	Ultimate			
	From	To	Av.	From	To	Av.	From	To	Av.	From	To	From	To
Long Leaf Pine..	7000	14000	1500	6000	9000	1500	1000	2000	350	1,500,000	2,250,000	40	50
Oregon Pine...........	7000	13000	1400	6000	9000	1400	900	1800	300	1,400,000	2,100,000	35	45
White Oak.............	6000	12000	1300	5000	8000	1300	1500	3000	500	1,300,000	1,950,000	45	55
Short Leaf Pine	6000	11000	1200	5000	8000	1200	900	1800	300	1,200,000	1,800,000	35	45
Spruce	5000	10000	1100	4000	7000	1100	800	1600	250	1,100,000	1,650,000	30	40
Norway Pine	5000	9000	1000	4000	6000	1000	700	1400	200	1,000,000	1,500,000	30	40
White Pine	4000	8000	900	4000	6000	900	600	1200	200	900,000	1,350,000	25	30
Fir....................	4000	7000	800	3000	5000	800	600	1200	200	800,000	1,200,000	25	30
Hemlock...............	3000	6000	700	3000	4000	700	600	1200	200	700,000	1,050,000	25	30
Cedar..................	3000	5000	600	3000	4000	600	500	1000	200	600,000	900,000	20	25

MATERIAL	Shear with the Grain			Shear Across the Grain			Tension with the Grain			Elastic Limit		Modulus of Resilience
	Ultimate		Safe	Ultimate		Safe	Ultimate		Safe	Ultimate		
	From	To	Av.	From	To	Av.	From	To	Av.	From	To	
Long Leaf Pine........	400	800	150	4000	6000	1000	8000	15000	1700	6000	12000	3.0
Oregon Pine...........	400	700	140	4000	5000	900	8000	14000	1600	6000	11000	3.0
White Oak.............	400	1000	200	4000	6000	900	7000	14000	1500	5000	11000	3.0
Short Leaf Pine	350	700	120	3000	5000	800	7000	13000	1400	5000	10000	2.5
Spruce.....	300	600	110	3000	4000	800	6000	12000	1300	4000	9000	2.5
Norway Pine	300	600	100	3000	4000	700	6000	11000	1200	4000	8000	2.5
White Pine	300	600	90	2000	3500	600	5000	10000	1100	3500	7000	2.0
Fir....................	250	500	80	2000	3000	500	5000	10000	1000	3000	6000	2.0
Hemlock.	200	400	70	2000	3000	500	4000	9000	900	2500	5000	2.0
Cedar..	200	400	60	2000	2500	400	4000	8000	800	2500	4500	1.5

Ultimate and Safe Strength of Concrete in Pounds Per Square Inch.

Modulus of Elasticity of P. C. Stone Concrete 1:2:4—60 Days Old for Various Stresses	Modulus of Elasticity	Strength of 1:2:4 P. C. Stone Concrete for Various Ages	Compression on Top Fibers of Beams			Modulus of Elasticity	
	Ultimate		Ultimate		Safe	Ultimate	
			From	To	Av.	From	To
Initial Mod. of Elasticity....	2,000,000	1 Day Old	200	300	0		
E. for Stress of 400 lbs pr. □	1,700,000	2 " "	400	700	100		
" " " 600 " "	1,600,000	4 " "	600	1000	200	800,000	1,300,000
" " " 800 " "	1,500,000	7 " "	900	1500	375	1,200,000	2,000,000
" " " 1000 " "	1,400,000	1 Month Old..............	1200	2000	500	1,600,000	2,600,000
" " " 1200 " "	1,300,000	2 " "	1400	2300	575	1,800.000	3,000,000
" " " 1400 " "	1,100,000	3 " "	1500	2500	625	2,000,000	3,300,000
" " " 1600 " "	900,000	6 " "	1600	2700	675	2,200,000	3,600,000
" " " 1800 " "	600,000	1 Year Old..................	1700	2900	725	2,300,000	3,800,000
E. for Ultimate Strength....	0	2 " "	1800	3000	750	2,400,000	4,000,000

These tables will cover variations of the material and give the range of strength that could be expected of good ordinary materials and workmanship. Inferior materials will come below the lowest limits given in these tables, and superior materials will come above the highest limits. The safe compressive unit stress to be used for long columns should be obtained from the use of some approved column formulae, which also should take care of possible eccentric applications of the load.

The safe extreme fiber stress for long, narrow beams and girders, including plate girders, not braced sideways, should also be obtained from some approved column formulae. In this manner the lateral strength of beams is provided for.

The following method is believed to conform with good practice for computing loads in buildings:

Figure all parts of the building for the full dead load.

Figure joists and beams for the full live load.

Figure girders for 85 to 90 per cent of the live load.

Figure the columns supporting the roof and top story of a building for the full live load. For each succeeding story below, make a reduction of 5 per cent in the full live load coming on the columns. This reduction must however, not exceed 50 per cent of the full live load for a many stored building.

Figure the foundations for one-third of the full live load.

Ultimate and Safe Strength of Masonry in Pounds Per Square Inch.

Material	Compression Ultimate From	Compression Ultimate To	Compression Safe Av.	Safe Bearing	Modulus of Elasticity Ultimate From	Modulus of Elasticity Ultimate To	Shear Ultimate From	Shear Ultimate To	Shear Safe Av.	Tension Ultimate From	Tension Ultimate To	Tension Safe Av.	Weight per Cubic Foot From	Weight per Cubic Foot To
Hard Brick Work in P. C.	2000	3000	200	275	1,500,000	2 500,000	......	.....	......	100	200	20	130	150
Common " P. C.	1500	2500	175	250	1,500,000	2,500,000	150	300	20	100	200	20	110	130
" " N C.	1000	2000	150	200	1,000,000	1,500,000	......	......	......	50	100	10	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	......	......	......	20	40	5	110	130
" " P.C.&LM.	1000	2000	150	200	1,000,000	1,500,000	......	......	......	50	100	10	110	130
Old Brick Work in P. C.	2000	3000	200	275	2,000,000	3,000,000	......	......	......	120	250	25	110	130
" " " N. C.	1500	2500	175	250	1,500,000	2,000,000	......	......	......	70	120	15	110	130
" " " L. M.	1000	2000	150	200	1,000,000	1,500,000	......	......	......	25	50	7	110	130
Brick Piers in P. C......	1500	2500	175	250	1,500,000	2,500,000	......	......	......	100	200	20	110	130
" " L. M......	800	1600	100	150	500,000	1,000,000	......	......	......	20	40	5	110	130
Rubble Work in P. C...	1000	2000	150	200	1,500,000	2,500,000	......	......	......	70	150	20	130	150
Coursed Rubble in P. C..	1500	2500	175	250	2,000,000	3,000,000	......	......	......	100	200	20	140	160
Neat P. C.............	2000	4000	200	300	1,500,000	3,000,000	1200	2400	300	400	800	70	80	90
Neat N. C.............	1000	3000	175	250	1,000,000	2,000,000	700	1500	125	200	400	30	60	70
P. C. Mortar 1 : 3......	1500	2500	175	250	1,000,000	2,000,000	200	400	35	200	400	30	120	130
N. C. Mortar 1 : 2......	800	1500	150	200	800 000	1,500,000	150	300	25	100	200	20	120	130
Lime Mortar...........	200	400	100	150	500,000	800,000	50	100	10	20	40	5	90	110
P. C. Stone Concrete 1:2:4	1500	3500	400	500	1,500,000	3,500,000	800	1200	125	200	400	40	140	150
N C. " " 1:2:5	1000	2000	200	300	1,000,000	2,000,000	500	1000	80	150	300	25	140	150
P. C. Cinder 1:2:5	800	1600	150	200	500,000	1,000,000	70	120	10	100	150	20	100	110
Granite..............	12000	20000	400	600	3,000,000	6,000,000	1200	2400	300	1200	2400	200	160	180
Limestone............	6000	12000	350	500	2,000,000	5,000,000	1000	2000	175	1000	2000	175	150	170
Sandstone.............	5000	10000	300	400	1,000,000	3,000,000	800	1600	125	800	1600	125	140	160
Brick and Tile..........	2000	5000	200	300	1,000,000	3,000,000	500	1000	80	500	1000	80	120	140

ULTIMATE AND SAFE STRENGTH OF IRON AND STEEL IN POUNDS PER SQUARE INCH

Material	Compression			Safe Bearing	Shear			Modulus of Elasticity		Weight per Cu. Ft.
	Ultimate		Safe Average		Ultimate		Safe	Ultimate		
	From	To			From	To	Average	From	To	
Hard Steel	36,000	40,000	18,000	26,000	45,000	55,000	12,000	28,000,000	31,000,000	490
Medium Steel	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Steel Pins	33,000	38,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Shop Rivets	24,000	29,000	16,000	24,000	50,000	60,000	12,000	"	"	"
Field Rivets	24,000	29,000	12,000	20,000	50,000	60,000	10,000	"	"	"
Cast Steel	60,000	90,000	12,000	26,000	50,000	60,000	12,000	29,000,000	32,000,000	"
Cast Iron	60,000	90,000	10,000	15,000	15,000	25,000	2,000	12,000,000	18,000,000	450

Material	Extreme Fiber Stress			Tension			Elastic Limit		Modulus of Resilience
	Ultimate		Safe Average	Ultimate		Safe Average	Ultimate		
	From	To		From	To		From	To	
Hard Steel	50,000	70,000	18,000	65,000	75,000	18,000	35,000	45,000	35
Medium Steel	40,000	60,000	16,000	60,000	70,000	16,000	30,000	40,000	35
Steel Pins	40,000	60,000	24,000	60,000	70,000	16,000	30,000	40,000	
Shop Rivets	40,000	60,000	24,000	48,000	58,000		24,000	30,000	
Field Rivets	40,000	60,000	18,000	46,000	54,000		24,000	30,000	
Cast Steel	60,000	90,000	16,000			18,000	35,000	50,000	
Cast Iron	30,000	40,000	3,500			3,000	10,000	20,000	1.2

PERCENTAGE OF HOOPING FOR VARIOUS CORE DIAMETERS AND HOOPING FOR HOOPED REINFORCED CONCRETE COLUMNS.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

	MAXIMUM PITCH OF SPIRALS TO BE NOT GREATER THAN 1/10 THE DIAM. OF COL. NOR GREATER THAN 3"																					Minimum No. of Rods
	3/16" Hooping		¼" Hooping					5/16" Hooping							⅜" Hooping							
Pitch (Diameter of Core)	1⅜"	1½"	1½"	1⅝"	1¾"	1⅞"	2"	1½"	1⅝"	1¾"	1⅞"	2"	2¼"	2½"	1⅝"	1¾"	1⅞"	2"	2¼"	2½"	2¾"	3"	
9	0.89	0.82	1.46																				
10	0.80	0.74	1.31																				
11	0.73	0.67	1.19																				
12	0.67	0.61	1.09	1.01	0.94	0.87	0.82	1.71	1.57	1.46	1.36	1.27	1.14	1.03						1.46	1.34	1.24	6
13	0.62	0.57	1.01	0.93	0.87	0.81	0.75	1.58	1.45	1.35	1.25	1.17	1.06	0.95					1.50	1.36	1.24	1.14	6
14	0.57	0.53	0.94	0.87	0.81	0.75	0.70	1.46	1.35	1.25	1.17	1.09	0.98	0.88				1.58	1.40	1.26	1.15	1.06	6
15	0.54	0.49	0.87	0.81	0.75	0.70	0.65	1.36	1.26	1.17	1.09	1.02	0.91	0.82			1.57	1.47	1.31	1.17	1.07	0.99	6
16	0.50		0.82	0.76	0.70	0.66	0.61	1.28	1.18	1.10	1.02	0.96	0.85	0.77		1.58	1.47	1.38	1.23	1.11	1.01	0.93	6
17	0.47		0.77	0.71	0.66	0.62	0.58	1.21	1.11	1.03	0.96	0.90	0.81	0.72		1.49	1.39	1.30	1.16	1.03	0.95	0.87	6
18			0.73	0.67	0.63	0.58	0.54	1.14	1.05	0.97	0.91	0.85	0.76	0.68	1.51	1.40	1.31	1.22	1.09	0.98	0.89	0.82	8
19			0.69	0.64	0.59	0.55	0.52	1.08	1.00	0.93	0.86	0.81	0.72	0.65	1.43	1.33	1.24	1.16	1.04	0.92	0.84	0.72	8
20			0.66	0.61	0.56	0.52	0.49	1.02	0.95	0.88	0.82	0.76	0.68	0.61	1.36	1.26	1.18	1.12	0.98	0.88	0.80	0.74	8
21			0.62	0.58	0.54	0.50		0.98	0.90	0.84	0.78	0.73	0.65	0.58	1.30	1.20	1.12	1.05	0.94	0.84	0.76	0.70	8
22			0.60	0.55	0.51	0.48		0.93	0.86	0.80	0.75	0.70	0.62	0.56	1.24	1.15	1.07	1.00	0.89	0.80	0.73	0.67	8
23			0.57	0.53	0.49			0.89	0.82	0.76	0.71	0.67	0.59	0.53	1.18	1.10	1.02	0.96	0.85	0.77	0.70	0.64	8
24			0.55	0.50				0.85	0.79	0.73	0.68	0.64	0.57	0.51	1.13	1.05	0.98	0.92	0.82	0.74	0.67	0.62	9
25			0.52	0.49				0.82	0.76	0.70	0.66	0.61	0.55	0.49	1.09	1.01	0.94	0.87	0.79	0.71	0.64	0.59	9
26			0.50					0.79	0.73	0.67	0.63	0.59	0.53		1.05	0.97	0.91	0.85	0.76	0.68	0.62	0.57	9
27			0.49					0.76	0.70	0.65	0.61	0.57	0.51		1.01	0.94	0.87	0.82	0.73	0.65	0.60	0.55	9
28								0.73	0.68	0.63	0.59	0.55	0.49		0.97	0.90	0.84	0.79	0.70	0.62	0.57	0.53	10
29								0.71	0.65	0.60	0.57	0.53			0.94	0.87	0.81	0.76	0.68	0.61	0.55	0.51	10
30								0.68	0.63	0.58	0.55	0.51			0.91	0.84	0.79	0.73	0.66	0.59	0.54	0.49	10
32								0.64	0.59	0.55	0.51	0.48			0.85	0.79	0.74	0.69	0.61	0.55	0.50		11
34								0.60	0.56	0.52	0.48				0.80	0.74	0.69	0.65	0.58	0.52	0.47		12
36								0.57	0.53	0.49					0.76	0.70	0.66	0.61	0.55	0.49			13
38								0.54	0.50						0.72	0.67	0.62	0.58	0.52				13
40								0.51	0.47						0.68	0.63	0.59	0.55	0.49				14
42								0.50							0.65	0.60	0.56	0.53					15
44								0.47							0.62	0.57	0.54	0.50					15
46															0.59	0.55	0.51	0.48					16
48															0.57	0.53	0.49						17
50															0.54	0.51							18
52															0.52	0.49							18
54															0.50								19

NOTE: Values inside of heavy lines are within the limits set by the Chicago Building Ordinance. See Sec. 546-567.

Hooping Rods	7/16" Hooping								½" Hooping								9/16" Hooping						
Pitch (Core Diameter, for Column Diameter add 4")	1¾"	1⅞"	2"	2⅛"	2¼"	2½"	2¾"	3"	1¾"	1⅞"	2"	2⅛"	2¼"	2½"	2¾"	3"	1⅞"	2"	2¼"	2½"	2¾"	3"	
16						1.50	1.37	1.25															6
17					1.57	1.41	1.29	1.18								1.53							6
18				1.57	1.48	1.33	1.22	1.11							1.59	1.45							8
19				1.49	1.40	1.26	1.16	1.05							1.50	1.37							8
20		1.60	1.51	1.41	1.33	1.29	1.10	1.00						1.57	1.43	1.30							8
21		1.53	1.43	1.35	1.27	1.14	1.04	0.95						1.50	1.36	1.24						1.58	8
22	1.56	1.46	1.37	1.29	1.22	1.09	1.00	0.91					1.59	1.43	1.30	1.18						1.51	8
23	1.49	1.39	1.31	1.23	1.16	1.07	0.95	0.87					1.52	1.37	1.24	1.13						1.44	8
24	1.43	1.34	1.25	1.18	1.11	1.00	0.91	0.83				1.54	1.45	1.31	1.19	1.09					1.51	1.38	9
25	1.37	1.28	1.20	1.13	1.07	0.96	0.88	0.80			1.57	1.48	1.40	1.26	1.14	1.04					1.45	1.33	9
26	1.32	1.23	1.16	1.09	1.03	0.93	0.84	0.77			1.51	1.42	1.34	1.21	1.10	1.01				1.53	1.39	1.28	9
27	1.27	1.19	1.11	1.05	0.99	0.89	0.81	0.74		1.55	1.45	1.37	1.29	1.16	1.06	0.97				1.47	1.34	1.23	9
28	1.23	1.15	1.07	1.01	0.96	0.86	0.77	0.72	1.60	1.50	1.40	1.32	1.25	1.12	1.02	0.93			1.58	1.42	1.29	1.18	10
29	1.18	1.10	1.04	0.98	0.92	0.83	0.75	0.69	1.55	1.44	1.35	1.27	1.20	1.08	0.99	0.90			1.52	1.37	1.25	1.14	10
30	1.14	1.07	1.00	0.94	0.89	0.80	0.73	0.67	1.50	1.40	1.31	1.23	1.16	1.05	0.95	0.87		1.61	1.47	1.32	1.20	1.10	10
32	1.07	1.00	0.95	0.88	0.84	0.75	0.68	0.63	1.40	1.31	1.23	1.15	1.09	0.98	0.89	0.82		1.51	1.38	1.24	1.13	1.04	11
34	1.01	0.94	0.88	0.83	0.79	0.71	0.64	0.59	1.32	1.23	1.15	1.09	1.03	0.92	0.84	0.77	1.56	1.46	1.30	1.17	1.06	0.98	12
36	0.95	0.89	0.83	0.79	0.74	0.67	0.61	0.56	1.25	1.16	1.09	1.02	0.97	0.87	0.79	0.73	1.47	1.38	1.23	1.10	1.00	0.92	13
38	0.90	0.84	0.79	0.75	0.70	0.63	0.58	0.53	1.18	1.10	1.03	0.97	0.92	0.83	0.75	0.69	1.40	1.31	1.16	1.05	0.95	0.87	13
40	0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50	1.12	1.05	0.98	0.92	0.87	0.79	0.71	0.65	1.33	1.24	1.10	0.99	0.90	0.83	14
42	0.82	0.76	0.72	0.67	0.64	0.57	0.52	0.48	1.07	1.00	0.94	0.88	0.83	0.75	0.68	0.62	1.26	1.18	1.05	0.95	0.86	0.79	15
44	0.78	0.73	0.68	0.64	0.61	0.55	0.50		1.02	0.95	0.89	0.84	0.79	0.71	0.65	0.60	1.20	1.13	1.00	0.90	0.82	0.75	15
46	0.75	0.70	0.65	0.62	0.59	0.52	0.49		0.98	0.91	0.85	0.80	0.76	0.68	0.62	0.57	1.15	1.08	0.96	0.87	0.79	0.72	16
48	0.72	0.67	0.63	0.59	0.56	0.50			0.94	0.87	0.82	0.77	0.73	0.65	0.60	0.55	1.10	1.03	0.92	0.83	0.75	0.69	17
50	0.69	0.64	0.60	0.57	0.54	0.48			0.90	0.84	0.79	0.74	0.70	0.63	0.57	0.52	1.06	0.99	0.88	0.80	0.72	0.66	18
52	0.66	0.62	0.58	0.54	0.51				0.86	0.80	0.75	0.71	0.67	0.60	0.55	0.50	1.02	0.96	0.85	0.77	0.70	0.64	18
54	0.64	0.59	0.56	0.52	0.49				0.83	0.78	0.73	0.68	0.65	0.58	0.53	0.49	0.98	0.92	0.82	0.74	0.67	0.61	19
56	0.61	0.57	0.54	0.50					0.80	0.75	0.70	0.66	0.62	0.56	0.51		0.95	0.89	0.79	0.71	0.65	0.59	20
60	0.57	0.53	0.50	0.47					0.75	0.70	0.65	0.62	0.58	0.52			0.88	0.83	0.74	0.66	0.60	0.55	21

FORMULAS FOR CONCRETE COLUMNS ACCORDING TO THE CHICAGO BUILDING ORDINANCES.

I. For All Concrete Columns:

W=Af W=Total safe load in lbs.

A =Total cross section area of columns in sq. ins. for II.

=Total cross section area inside of hooping in sq. ins. for III.

f =Average allowable unit stress in lbs. per sq. in. (in II and III).

p =Percentage of vertical steel (expressed in whole numbers).

p′ =Percentage of hooping steel (expressed in whole numbers).

II. Reinforced Concrete Columns

1:1:2 Concrete $f=580\ (1+0.09p) = 580+52.2p$

1:1½:3 Concrete $f=480\ (1+0.11p) = 480+52.8p$

1:2:4 Concrete $f=400\ (1+0.14p) = 400+56p$

III. Hooped Reinforced Concrete Columns:

1:1:2 Concrete $f=725\ (1+0.25p')\ (1+0.09p) = (1+.25p')\ (725+65.25p)$

1:1½:3 Concrete $f=600\ (1+.30p')\ (1+0.11p) = (1+.30p')\ (600+66p)$

1:2:4 Concrete $f=500\ (1+.375p')\ (1+.14p) = (1+.375p')\ (500+70p)$

Maximum height of columns must not exceed 12 × diameter, and no column shall have a cross section area of less than 64 sq. in.

(See Sec. 552 Building Ordinances of Chicago, Ill.)

TABLE I.

Copyrighted 1916, by Benj. E. Winslow.

Safe Extreme Fiber Stresses for Reinforced Concrete Beams in Accordance with the Chicago Building Ordinance Requirements for Concrete of Various Mixtures and Various Safe Stresses in the Steel Reinforcement. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Percentage of tensile reinforcing.	Mixture of concrete. Stone. 1:1:2.	1:1½:3.	1:2:4.	1:2½:5.	1:3:7.	Stress in steel. 16000.	18000.
0.00	58	48	40	35	30	0	0
0.01	11	11	11	11	11	9	11
0.02	21	21	21	21	21	19	21
0.03	31	31	31	31	31	28	31
0.04	41	41	41	41	41	37	42
0.05	50	50	50	50	50	45	50
0.06	60	60	60	60	60	55	60
0.07	70	70	70	70	70	65	70
0.08	80	80	80	80	80	70	80
0.09	90	90	90	90	90	80	90
0.10	100	100	100	100	100	90	100
0.11	115	115	115	110	110	100	115
0.12	125	125	125	120	120	110	125
0.13	135	135	135	130	130	120	135
0.14	145	145	145	140	140	125	145
0.15	150	150	150	145	145	135	150
0.16	160	160	160	155	155	145	160
0.17	170	170	170	165	165	150	170
0.18	180	180	180	175	175	160	180
0.19	190	190	190	185	185	170	190
0.20	205	205	205	200	200	180	205
0.22	220	220	220	215	215	195	220
0.24	240	240	240	235	235	210	240
0.26	260	260	260	250	250	230	260
0.28	280	280	275	270	270	245	275
0.30	300	300	295	295	290	265	295
0.32	320	320	315	315	310	280	315
0.34	335	335	330	330	325	295	330
0.36	355	355	350	350	345	310	350
0.38	375	375	370	370	365	330	375
0.40	395	395	390	390	385	345	390
0.42	415	415	410	400	400	365	410
0.44	430	430	425	420	420	380	425
0.46	450	450	445	440	440	395	445
0.48	470	470	465	460	455	410	465
0.50	490	485	480	475	470	430	480
0.52	510	505	500	495	490	445	515
0.54	525	520	515	510	505	460	515
0.56	545	540	535	530	515	480	535
0.58	565	560	555	550	520	495	555
0.60	585	580	575	570	530	510	575
0.62	600	595	590	585	535	525	595
0.64	620	615	610	595	540	540	610
0.66	640	635	630	600	540	560	630
0.68	660	655	650	605	545	575	650
0.70	675	670	665	610	550	590	665
0.72	695	690	680	620	555	605	670
0.74	715	710	685	625	560	620	700
0.76	730	725	690	630	565	635	720
0.78	750	745	695	635	570	655	735
0.80	770	760	700	635	575	670	755
0.82	790	780	710	640	580	685	770
0.84	805	795	715	650	585	700	790
0.86	820	805	720	655	590	715	805
0.88	840	810	725	660	595	730	825
0.90	860	815	730	660	600	750	840
0.92	875	820	735	665	600	765	860
0.94	895	825	740	670	605	780	875
0.96	920	835	745	675	610	795	895
0.98	930	840	750	680	615	810	910
1.00	950	845	755	685	620	825	930
1.1	980	870	780	700	635	905	1015
1.2	1010	895	800	720	650	980	1105
1.3	1030	920	815	740	660	1055	1190
1.4	1055	940	835	750	680	1135	1275
1.5	1080	960	850	760	690	1205	1360
1.6	1100	980	865	780	695	1285	1445
1.7	1120	995	880	790	710	1355	1530
1.8	1140	1010	895	800	720	1435	1610
1.9	1160	1025	905	810	725	1505	1695
2.0	1175	1040	920	830	740	1580	1780
2.5	1250	1090	965	865	775	1945	2190
3.0	1310	1150	1010	895	800	2305	2590
3.5	1360	1190	1040	925	820	2660	2990
4.0	1405	1220	1070	950	840	3010	3385
4.5	1440	1250	1090	965	860	3355	3770
5.0	1470	1280	1110	980	870	3700	4165

See note on following page.

TABLE II.

Ultimate Extreme Fiber Stresses for Concrete Beams Reinforced with High Carbon Steel—Straight Line Theory.

By L. J. MENSCH, Mem. Am. Soc. C. E.

% tensile steel.	Ultimate Compressive Strength Obtained from Cylinder Tests. 2900	2400	2000	1750	1500	700
	1:1:2	1:1½:3	1:2:4	1:2½:5	1:3:7	
0.25	1040	1030	1020	1010	1010	960
0.30	1240	1230	1220	1200	1190	1080
0.35	1430	1420	1400	1380	1370	1200
0.40	1630	1610	1580	1560	1550	1330
0.45	1820	1800	1760	1740	1710	1440
0.50	2010	1970	1940	1900	1870	1540
0.55	2190	2150	2110	2060	2030	1620
0.60	2370	2330	2280	2230	2170	1700
0.65	2540	2500	2440	2370	2310	1800
0.70	2720	2650	2600	2520	2450	1800
0.75	2900	2820	2740	2660	2590	1800
0.80	3070	2990	2900	2800	2720	1800
0.85	3240	3150	3040	2930	2830	1800
0.90	3400	3300	3180	3060	2950	1800
0.95	3560	3440	3320	3200	3050	1800
1.00	3700	3570	3450	3310	3160	1800
1.10	4020	3860	3700	3520	3350	1800
1.20	4300	4120	3930	3730	3510	1800
1.30	4600	4380	4140	4000	3600	1800
1.40	4860	4610	4330	4000	3600	1800
1.50	5120	4820	4520	4000	3600	1800
1.60	5370	5050	4600	4000	3600	1800
1.70	5600	5250	4600	4000	3600	1800
1.80	5820	5450	4600	4000	3600	1800
1.90	6040	5600	4600	4000	3600	1800
2.00	6260	5750	4600	4000	3600	1800
2.25	6700	5800	4600	4000	3600	1800

TABLE III.

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Safe Extreme Fiber Stresses in Pounds per Square Inch for Double Reinforced Concrete Beams for Various Percentages of Top and Bottom Steel. Straight Line Theory.

BY BENJ. E. WINSLOW, Mem. A. I. A. and Mem. Am. Soc. C. E.

Maximum Compression on Extreme Fiber of Concrete=700 Lbs. per Sq. In. Maximum Tension in Steel Reinforcement=18000 Lbs. per Sq. In. Mixture of Concrete 1:2:4. Ratio of Modulus of Elasticity of Steel to That of Concrete=15. Ratio of Depth of Top Steel to Depth of Bottom Steel Below Top of Beam=0.10. Values for Other Steel and Concrete Stresses Are Directly Proportionate to Those Given in This Table.

Percentage of Tensile Steel	Percentage of Compressive Steel 0.00	0.10	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	Percentage of Tensile Steel
0.60	575	578	579	580	581	582	583	584	584	585	586	587	588	589	0.60
0.62	595	596	597	599	600	601	602	603	604	605	606	607	608	609	0.62
0.64	610	612	613	615	616	618	619	621	622	624	625	627	628	629	0.64
0.66	630	632	633	635	636	638	639	641	642	644	645	647	648	649	0.66
0.68	650	652	653	655	656	658	659	661	662	663	665	666	667	668	0.68
0.70	665	667	668	670	671	673	674	676	677	678	680	682	684	686	0.70
0.72	680	688	689	691	693	694	696	697	699	700	702	703	705	706	0.72
0.74	685	704	706	707	709	710	712	713	715	716	718	719	721	723	0.74
0.76	690	720	726	728	729	731	732	734	735	737	738	740	741	743	0.76
0.78	695	726	744	746	747	749	750	752	753	755	757	759	761	763	0.78
0.80	700	731	762	764	766	768	770	772	774	776	778	780	781	783	0.80
0.82	710	739	779	782	784	786	788	790	792	794	796	798	800	802	0.82
0.84	715	743	790	800	802	804	806	808	810	812	814	816	818	821	0.84
0.86	720	750	795	820	822	824	826	828	830	832	834	836	838	840	0.86
0.88	725	755	800	839	842	844	846	848	850	852	854	856	858	860	0.88
0.90	730	760	807	858	861	863	866	868	870	872	874	876	878	880	0.90
0.92	735	765	812	873	880	883	885	887	890	892	894	896	898	900	0.92
0.94	740	770	818	888	900	902	904	906	908	910	912	914	916	918	0.94
0.96	745	775	823	892	920	922	924	926	928	930	932	934	935	937	0.96
0.98	750	780	828	900	938	940	942	944	946	948	950	952	954	956	0.98
1.00	755	786	832	905	956	958	960	962	964	967	969	972	974	976	1.00
1.10	780	811	853	930	1010	1060	1061	1063	1065	1066	1068	1069	1071	1072	1.10
1.20	800	828	874	954	1031	1105	1155	1157	1159	1161	1163	1165	1167	1170	1.20
1.30	815	850	895	978	1058	1130	1210	1252	1254	1256	1258	1260	1262	1265	1.30
1.40	835	869	916	1006	1076	1156	1232	1310	1345	1348	1351	1354	1358	1362	1.40
1.50	850	882	935	1020	1100	1178	1255	1331	1410	1450	1452	1455	1457	1460	1.50
1.60	865	899	950	1034	1115	1196	1276	1352	1435	1511	1547	1550	1553	1555	1.60
1.70	880	913	967	1054	1130	1215	1296	1374	1455	1538	1630	1650	1652	1655	1.70
1.80	895	928	983	1064	1149	1232	1316	1394	1480	1560	1645	1710	1747	1750	1.80
1.90	905	940	995	1082	1162	1250	1332	1414	1500	1580	1665	1725	1830	1848	1.90
2.00	920	952	1008	1100	1178	1266	1350	1432	1513	1600	1680	1760	1840	1918	2.00
2.50	965	1004	1055	1152	1241	1331	1420	1510	1595	1686	1715	1855	1945	2026	2.50
3.00	1010	1048	1105	1196	1291	1385	1480	1570	1660	1750	1840	1930	2020	2108	3.00
3.50	1040	1080	1140	1234	1334	1427	1515	1615	1705	1806	1890	1990	2080	2174	3.50
4.00	1070	1115	1170	1266	1366	1464	1560	1665	1755	1852	1940	2040	2130	2230	4.00
4.50	1090	1145	1205	1295	1395	1500	1595	1700	1795	1888	1980	2080	2180	2278	4.50
5.00	1110	1160	1235	1315	1415	1525	1620	1730	1825	1924	2020	2120	2220	2318	5.00

For values above heavy line, tension in steel is equal to 18000 lbs. per square inch.

For values below heavy lines compression in concrete is equal to 700 lbs. per square inch.

Values for other steel and concrete stresses are directly proportional to those given in Tables I and III.

Table I gives the Extreme Fiber Stress for rectangular reinforced concrete beams for various mixtures of concrete and stresses in the steel for percentages of steel varying from plain concrete beams, to beams reinforced with as high as 5% of steel; all in accordance with the Building Ordinance Requirements for the City of Chicago.

In Table II are given in the headings the ultimate compressive strength of concrete as assumed by the Chicago Building Ordinance for various concrete mixtures. According to the theory of Mr. L. J. Mensch as published in the Journal of the American Concrete Institute for December, 1914, these compressive strengths, if introduced in the straight line formula do not agree with scientific tests on reinforced concrete beams to rupture. In order to make the straight line theory agree with the tests at rupture the ultimate extreme fiber stresses as given in Table II must be assumed instead of the values given in the headings.

The value 700 in the heading is for 1:2:4 cinder*-concrete. It is also valid for stone concrete a few days old. The depth of the reinforced-concrete beams is of course assumed to be the depth to the center of the steel. Tables I, II and III assume only pure tension or compression failures. Special calculations should therefore be made for bond, shear and diagonal tension.

Table III gives the Extreme Fiber Stress for rectangular Double Reinforced concrete beams, for various percentages of tensile and compressive steel; all in accordance with the Building Ordinance Requirements for the City of Chicago. See Sec. 546-567.

RECOMMENDATIONS FOR THE DESIGN OF HOOPED COLUMNS.

Concrete 1:2:4.
Rods round ½"° to 1¼"°.
Core diameter 4" less than column diameter.
As few different sizes of columns as possible.
Column diameter never less than 1/12th the story height.
Percentage of vertical steel from 1% to 7%.
Percentage of hooping steel from 0.5% to 1.5%.
Maximum pitch of spiral 1/10th of core diameter, or 3".
Minimum pitch of spiral 1½".
Maximum size of spiral steel ½"°.
Minimum size of spiral steel 3/16"°.
Maximum spacing of vertical steel 9" or ⅛ circumference of column.
Minimum spacing of vertical steel 3½".
Minimum lap of vertical steel 18".
Lap of vertical steel for average core stresses less than 1000#"—25 diameters.
Lap of vertical steel for average core stresses greater than 1000#"—30 diameters.
Length of plain round stub bars in footings, 60 diameters.
Length of square twisted stub bars in footings, 40 diameters.
Stub bars embedded one-half their length in footing and one-half in column.
Length of spirals to be clear story height with one extra turn at top and bottom.
3 vertical lines of spacers for all spirals under 18" diameter.
4 vertical lines of spacers for all spirals over 18" diameter.
When columns require a large percentage of vertical steel it is often more economical to use a structural steel column and encase it in concrete. It must be remembered that the working stress of reinforcing steel is only (nxfc) while that of a structural column encased in concrete is $18000 - 70\frac{1}{r}$.

Metric Tables.

		Approximate Equivalent.		Accurate Equivalent.
1 inch	[length]	2½	cubic centimeters	2.539
1 centimeter		0.4	inch	0.393
1 yard		1	meter	0.914
1 meter (39.37 inches)		1	yard	1.093
1 foot		30	centimeters	30.479
1 kilometer (1,000 meters)		⅝	mile	0.621
1 mile		1½	kilometers	1.600
1 gramme	[weight]	15.½	grains	15.432
1 grain		0.064	gramme	0.064
1 kilogramme (1,000 grammes)		2.2	pounds avoirdupois	2.204
1 pound avoirdupois		½	kilogramme	0.453
1 ounce avoirdupois (437½ grains)		28 1/3	grammes	28.349
1 ounce troy, or apothecary (480 grains)		31	grammes	31.103
1 cubic centimeter	[bulk]	1.06	cubic inch	1.060
1 cubic inch		16 1/3	cubic centimeters	16.386
1 liter (1,000 cubic centimeters)		1	U. S. standard quart	0.946
1 United States quart		1	liter	1.057
1 fluid ounce		29½	cubic centimeters	29.570
1 hectare (10,000 square meters)	[surface]	2½	acres	2.471
1 acre		0.4	hectare	0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Handy Table.

Diameter of a circle × 3.1416 = circumference.
Radius of a circle × 6.283185 = circumference.
Square of the diameter of a circle × 0.7854 = area.
Square of the circumference of a circle × 0.07958 = area.
Half the circumference of a circle × half its diameter = area.
Circumference of a circle × 0.159155 = radius.
Square root of the area of a circle × 0.56419 = radius.
Circumference of a circle × 0.31831 = diameter.
Square root of the area of a circle × 1.12838 = diameter.
Diameter of a circle × 0.86 = side of inscribed equilateral triangle.
Diameter of a circle × 0.7071 = side of an inscribed square.
Circumference of a circle × 0.225 = side of an inscribed square.
Circumference of a circle × 0.282 = side of an equal square.
Diameter of a circle × 0.8862 = side of an equal square.
Base of a triangle × ½ the altitude = area.
Multiplying both diameters and .7854 together = area of an ellipse.
Surface of a sphere × 1/6 of its diameter = solidity.
Circumference of a sphere × its diameter = surface.
Square of the diameter of a sphere × 3.1416 = surface.
Square of the circumference of a sphere × 0.3183 = surface.
Cube of the diameter of a sphere × 0.5236 = solidity.
Cube of the radius of a sphere × 4.1888 = solidity.
Cube of the circumference of a sphere × 0.016887 = solidity.
Square root of the surface of a sphere × 0.56419 = diameter.
Square root of the surface of a sphere × 1.772454 = circumference.
Cube root of the solidity of a sphere × 1.2407 = diameter.
Cube root of the solidity of a sphere × 3.8978 = circumference.
Radius of a sphere × 1.1547 = side of inscribed cube.
Square root of (⅓ of the square of) the diameter of a sphere = side of inscribed cube.
Area of its base × ⅓ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Area of one of its sides × 6 = surface of a cube.
Altitude of trapezoid × ½ the sum of its parallel sides = area.

Square root of ($\frac{1}{3}$ of the square of) the diameter of a sphere = side of inscribed cube.
Area of its base × $\frac{1}{3}$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Area of one of its sides × 6 = surface of a cube.
Altitude of trapezoid × $\frac{1}{2}$ the sum of its parallel sides = area.

TABLE OF SQUARE ROOTS.

No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.
25	5.	650	25.46	1400	37.42	2600	50.99
50	7.071	700	26.46	1450	38.08	2700	51.96
75	8.66	750	27.39	1500	38.73	2800	52.91
100	10.00	800	28.28	1550	39.37	2900	53.85
125	11.18	850	29.15	1600	40.00	3000	54.77
150	12.25	900	30.00	1650	40.62	3200	56.57
175	13.23	950	30.82	1700	41.23	3400	58.30
200	14.14	1000	31.62	1800	42.43	3600	60.00
250	15.81	1050	32.40	1900	43.59	3800	61.64
300	17.32	1100	33.16	2000	44.72	4000	63.24
350	18.70	1150	33.91	2100	45.82	4200	64.80
400	20.00	1200	34.64	2200	46.90	4400	66.32
450	21.21	1250	35.36	2300	47.95	4600	67.82
500	22.36	1300	36.06	2400	48.99	4800	69.28
550	23.45	1350	36.74	2500	50.00	5000	70.72
600	24.49						

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1.0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

*Greatest density at 39.1° Fahr.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and $8\frac{2}{5}$ inches deep will contain one bushel; 16 by $8\frac{2}{5}$ inches and 8 inches deep will contain half a bushel; 8 by $8\frac{2}{5}$ inches and 8 inches deep will contain one peck; 8 inches square and $4\frac{1}{5}$ inches deep will contain one gallon; 7 by 4 inches and $4\frac{4}{5}$ inches deep will contain half a gallon; 4 inches square and $4\frac{1}{5}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch.	Feet Head	Equals Pressure per Square Inch	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch
1	43	65	28.15	130	56.31	195	84 47	260	112 62	350	151 61
5	2 16	70	30.32	135	58.48	200	86 63	265	114 79	360	155 94
10	4 33	75	32 48	140	60.64	205	88 80	270	116.96	370	160 27
15	6 49	80	34 65	145	62 81	210	90 96	275	119.12	380	164 61
20	8.66	85	36.82	150	64.97	215	93 14	280	121.29	390	168 94
25	10.82	90	38 98	155	67.14	220	95.30	285	123.45	400	173 27
30	12 99	95	41.15	160	69.31	225	97 49	290	125 62	500	216 58
35	15.16	100	43 31	165	71.47	230	99 63	295	127.78	600	259 90
40	17.32	105	45.48	170	73.64	235	101 79	300	129.95	700	303 22
45	19 49	110	47 64	175	75.80	240	103 96	310	134 28	800	346 54
50	21.65	115	49.81	180	77.97	245	106 13	320	138 62	900	389 86
55	23.82	120	51.98	185	80.14	250	108 29	330	142 95	1,000	433 18
60	25 99	125	54.15	190	82.30	255	110 46	340	147 28		

Weights of Materials.
Dry Woods.

	Lbs. Board ft.	Lbs. Cubic ft.		Lbs. Board ft.	Lbs. Cubic ft.
Apple	4.1	49.	Iron Wood	6.	71.
Ash, American white	3.9	47.	Larch	3.	35.
Birch	3.9	46.	Lignum Vitæ	6.9	83.
Beech	3.7	43.	Mahogany, Honduras	2.9	35.
Boxwood	5.	60.	Mahogany, Spanish	4.4	53.
Cedar, American	2.9	35.	Maple	4.1	49.
Cedar, W. Indian	3.9	47.	Maple, soft	3.5	42.
Cedar, Lebanon	2.5	30.	Oak, live	4.9	59.3
Cherry	3.5	42.	Oak, red	3.9	45.
Chestnut	3.4	41.	Oak, white	4.3	52.
Cork	1.3	15.	Pine, Southern	3.7	45.
Elm	2.9	35.	Pine, white	2.1	25.
Ebony	6.3	76.1	Pine, yellow	2.8	34.3
Hemlock	2.1	25.	Spruce	2.1	25.
Hickory	4.4	53.	Sycamore	3.1	37.
Hornbeam	2.9	47.	Walnut	3.2	38.

Building Materials—Stacked.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed	150	Glass—window	157
" common	125	Granite	170
" soft	100	Lime—quick	53
Cement—Portland	100	Plaster of Paris	70
Cement—Rosedale	56	Sand	90-106
Cinders—dry	72	Sandstone	151
Cinders—packed	90	Shale	162
Earth—dry, shaken	82- 92	Slate	175
Earth—rammed	92-100	Trap rock	187

Masonry.

	Lbs. per cubic ft.		Lbs. per cubic ft.
Brick—pressed or paving	140	Granite	160
Brick—hard, common	120	Mortar and plaster	120
Brick—soft	100	Rubble—limestone, common	140
Brick—hollow	90	Rubble—limestone, cut face	150
Concrete—stone	150	Rubble—sandstone, common	140
Concrete—cinder	96	Rubble—sandstone, cut face	150

Building Materials—In Construction.
Roofing.

	Lbs. per square ft.		Lbs. per square ft.
Copper—sheet	0.75 to 1.25	Shingles—wood 16″	2
Felt and gravel	8 to 10	Singles—wood 16″	2
Iron—corrugated	1 to 3.75	Slate—average	10
Iron—galvanized	1 to 3	Tile—fancy, laid in mortar	25 to 30
Iron—sheet, black, painted	1.5	Tile—plain, average	12
Ready composition roofing	1 to 1.5	Tin and paint	1
Sheet lead	4 to 8	Zinc	1 to 2

Floors.

	Lbs. per sq. ft.		Lbs. per sq. ft.
Flat arches (tile) 3″ thick	17	Flat arches (tile) 12″ thick	39
" " " 4″ "	18	" " " 14″ "	43
" " " 6″ "	25	" " " 16″ "	49
" " " 8″ "	31	Book tile 2″ thick	15
" " " 10″ "	35	" " 3″ "	17
Brick arches 4″ thick and concrete	70	Beam tile	15

Table for Weights of Yellow Pine Joists, Studs and Rafters on the Assumption That One Board Foot of Y. P. Weighs 2.8 Pounds.

Spacing	Size	Weight per Sq. Foot	Size	Weight Per Sq. Foot	Size	Weight
12″	2″x4″	1.87	2″x6″	2.8	2″x8″	3.74
14″	"	1.60	"	2.4	"	3.20
16″	"	1.40	"	2.1	"	2.80
18″	"	1.25	"	1.87	"	2.50
20″	"	1.12	"	1.68	"	2.24
22″	"	1.02	"	1.53	"	2.04
12″	2″x10″	4.68	2″x12″	5.61	2″x14″	6.55
14″	"	4.00	"	4.80	"	5.60
16″	"	3.50	"	4.20	"	4.90
18″	"	3.13	"	3.75	"	4.38
20″	"	2.80	"	3.36	"	3.92
22″	"	2.55	"	3.06	"	3.57

Partitions.

	Lbs. per sq. ft.
Gypsum partition blocks 3″ thick....	10
" " " 4″ "	12
" " " 5″ "	14
" " " 6″ "	16
Plaster on brick, tile or concrete...	5

	Lbs. per sq. ft.
Partition tile 3″ thick.............	17
" " 4″ "	18
" " 6″ "	25
" " 8″ "	31
" " 10″ "	35

Ceiling.

	Lbs. per sq. ft.
Lath and plaster 2 coats...........	9
Lath and plaster 3 coats...........	10
Suspended ceiling	10

Sheathing, Flooring, etc.

	Lbs. per sq. ft.
Pine, Hemlock, Spruce, Poplar, Redwood, per inch thick..............	3
Chestnut, Maple	4

Weight per Square Foot of Sheet Lead.

1/62 inch thick...................2	lbs.
3/64 " " 2½	"
1/25 " " 3	"
1/16 " " 4	"
1/14 " " 5	"
1/12 " " 6	"
1/10 inch thick...................7	lbs.
⅛ " " 8	"
5/32 " " 10	"
3/16 " " 12	"
7/32 " " 14	"
¼ " " 16	"

Miscellaneous Items.

While the following items vary considerably in weight, the values given below are fair averages and may be used for preliminary computations.

	Lbs. per sq. ft.
Iron stair construction	50
Concrete stair construction	150
Wood stair construction	20
Sidewalk lights in concrete........	30
Reinforcement of concrete	6
Steel joists per sq. ft. of floor.....	6
Steel girders per sq. ft. of floor......	4

Contents of Storage Warehouses.

Material.	Weight per Cu. ft.	Allowable Height of Pile in ft.
Groceries Etc.		
Beans—in bags	40	8
Canned goods—cases	58	6
Coffee—roasted, in bags...	33	8
Coffee—green, in bags....	39	8
Flour—in barrels	40	5
Molasses—in barrels......	48	5
Rice—in bags	58	6
Sal Soda—in barrels......	46	5
Salt—in bags	70	5
Soap powder—in cases.....	38	8
Starch—in barrels	25	6
Sugar—in barrels	43	5
Sugar—in cases	51	6
Tea—in chests	25	8
Wines and Liquors, in bbls.	38	6
Dry Goods, Cotton, Wool, Etc.		
Burlap—in bales	43	6
Coir Yarn, in bales.......	33	8
Cotton — in bales, compressed	18	8
Cotton Bleached Goods — in cases	28	8
Cotton Flannel—in cases..	12	8
Cotton Sheeting—in cases.	23	8
Cotton Yarn—in cases....	25	8
Excelsior—compressed	19	8
Hemp—Manila, compressed	30	8
Linen Goods—in cases....	30	8
Wool—in bales, not compressed	13	8
Wool—worsteds, in cases..	27	8
Hardware, Etc.		
Sheet tin—in boxes.......	278	2
Wire—insulated copper, in coils	63	5
Wire—galvanized iron, in coils	74	4.5
Wire—magnet, on spools..	75	6
Drugs, Paints, Oils, Etc.		
Glycerine—in cases.......	52	6
Linseed oil—in bbls.......	36	6
Logwood extract—in boxes	70	5
Rosin—in bbls............	48	6
Shellac—gum	38	6
Soda — Caustic, in iron drums	88	3.33
Soda—Silicate, in bbls....	53	6
Sulphuric Acid	60	1.66
White Lead Paste—in cans	174	3.5
White Lead—dry	86	4.75
Red Lead and Litharge Putty—dry	132	3.75
Miscellaneous.		
Glass and Chinaware — in cases	40	8
Hides and Leather — in bales	20	8
Paper — newspaper and strawboard	35	6
Paper—writing and calendared	60	6
Rope—in coils	32	6

NOMENCLATURE OF DRAWINGS

We present in the following pages a collation of symbols for plan nomenclature, which we hope will be the means of bringing about a more uniform practice. In addition to the convenience, which will result from uniform practice to those compelled to examine, estimate from or execute plans from different offices; it will be found that the proficiency of draftsmen will not be so seriously affected on changing from office to office if practice becomes uniform.

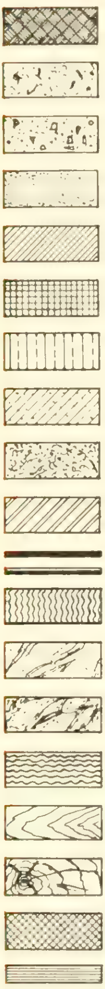
General symbols presented have been collated from various sources. To assist memory those symbols have been selected which are suggestive in their make up.

For illustration all lines indicating water pipes have a periodic double indentation suggestive of a "w"; gas lines a periodic embryo "G", etc.

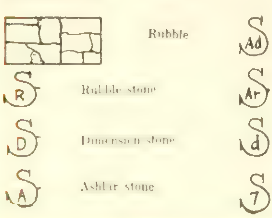
Lighting symbols are those adopted by the American Institute of Architects and the National Electrical Contractors' Association, except that 50 watts is taken as the standard for one light unit instead of 16 c. p.

Structural iron standard symbols; the Osborn systems are so generally understood and used that it hardly seems necessary to publish same. (See Cambria pocket book, 1906 edition, p. 309.)

GENERAL SYMBOLS



	In color system use
Earth	Black
Cinders	Green
Concrete	Brown
Stone	Blue
Brick	Red
Structural tile	Brown
Composition wall blocks	Blue
Architectural terra cotta	Brown
Plaster	Blue
Structural iron	Green
Sheet metal	Green
Floor tile, tile and mosaics	Brown
Marble (in elevation)	Blue
Marble (in section)	Blue
Terrazo	Black
Wood in section (soft wood) with grain. (hard wood)	Yellow Brown
Wood in section (soft wood) across grain (hard wood)	Yellow Brown
Cork	Brown
Glass	Blue
Rubble	



Rubble stone

Dimension stone

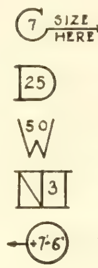
Ashlar stone

Dressed ashlar

Rock faced ashlar

Any stone dressed

Not described, small numeral refers to details and specifications



Column · Small numeral indicates No. of particular column

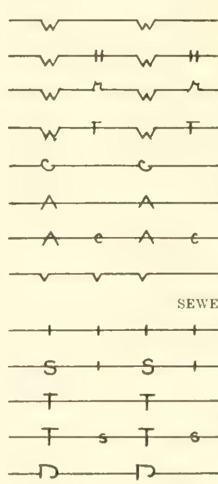
Door: Small numeral indicates No. of particular door

Window. Small numeral indicates No of particular window

Indicates designating No of a room or space.

Elevation of point; small numerals indicate elevation above zero point.

PIPING SYMBOLS



	In color system
Cold water	Blue
Hot water	Red
Hot water return	Red
Filtered or drinking water	Blue
Gas piping	Green
Air piping	Green
Compressed air piping	Green
Vacuum cleaning	Green
SEWERAGE AND DRAINAGE	
Iron sewer pipe	Green
Sanitary iron sewer pipe	Green
Tile sewer	Red
Sanitary Tile Sewer	Red
Drainage tile	Brown
O- S.P. Soil pipe	Green
O- W.P. Waste pipe	Green
O- D.S. Down spout	Green
O- V.R. Vent riser	Green

Floor drain	Brown
2 Bracket: Prefix with "F" if for fuel	Blue
3 Ceiling: Prefix with "F" if for fuel	Blue
7 Floor outlet: Prefix with "F" if for fuel	Blue
4/2 Combined gas and electric; lower figure indicates No. of gas tips, upper figure Indicates No. of 50 watt electric lamps.	Blue

Ceiling outlet; electric only. No. in center indicates No. of standard 50 watt electric lamps

Ceiling outlet; combination 4/2 indicates 200 watt electric light capacity and 2 gas burners

Bracket outlet; electric only. Numeral in center indicates No. 50 watt electric lamps

Bracket outlet; combination 4/2 indicates 200 watt electric light capacity and 2 gas burners

Show as many symbols as there are switches, or in case of a very large group of switches indicate the number of switches by a Roman numeral, thus: S^1 XII means 12 single pole switches.
Describe type of switch in specifications, that is flush or surface, push button or snap.

Wall or baseboard receptacle outlet: Numeral in center indicates No. of stand. 50 watt electric lamps

Floor outlet: Numeral in center indicates number of 50 watt electric lamps

Outlet for outdoor standard or pedestal; electric only. Numeral indicates No. of 50 watt electric lamps

Outlet for outdoor standard or pedestal: Combination 6/6 indicates 300 watt electric light capacity lamps, 6 gas burners

Special outlet for lighting, heating or power current as described in specifications

Drop cord outlet

One light outlet for lamp receptacle

Arc lamp outlet

Ceiling fan outlet

S^1 S. P. Switch outlet.......

S^2 D. P. Switch outlet.......

S^3 3-way switch outlet.......

S_D Automatic door switch outlet ....

S_E Electrolier switch outlet...

Show as many symbols as there are switches, or in case of a very large group of switches indicate the No. of switches by a Roman numeral thus: S^1 XII means 12 single pole switches. Describe type of switch in specifications, that is flush or surface, push button or snap

Meter outlet

Distribution panel

Junction or pull box

Motor outlet: Numeral in center indicates horse power

Motor control outlet

Transformer

Circuit for clock, telephone, bell or other service run under floor concealed. Kind of service wanted ascertained by symbol to which line connects

Circuit for clock, telephone, bell or other service run under floor above, concealed. Kind of service wanted ascertained by symbol to which line connects

Main or feeder run under floor concealed

Main or feeder run concealed under floor above

Main or feeder run exposed

Branch circuit run concealed under floor

Branch circuit run concealed under floor above

Branch circuit run exposed

Pole line

Riser

Telephone outlet; Private service

Telephone outlet; Public service

Bell outlet

Buzzer outlet

Push button outlet; Numeral indicates No. of pushes

Annunciator; Numeral indicates No. of points

Speaking tube

Watchman clock outlet

Watchman station outlet

Master time clock outlet

Secondary time clock outlet

Door opener

Special outlet, signal system as described in specifications

Battery outlet

NOTE: If other than standard 50 watt electric lamps capacity is desired specifications should describe capacity of lamp desired

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

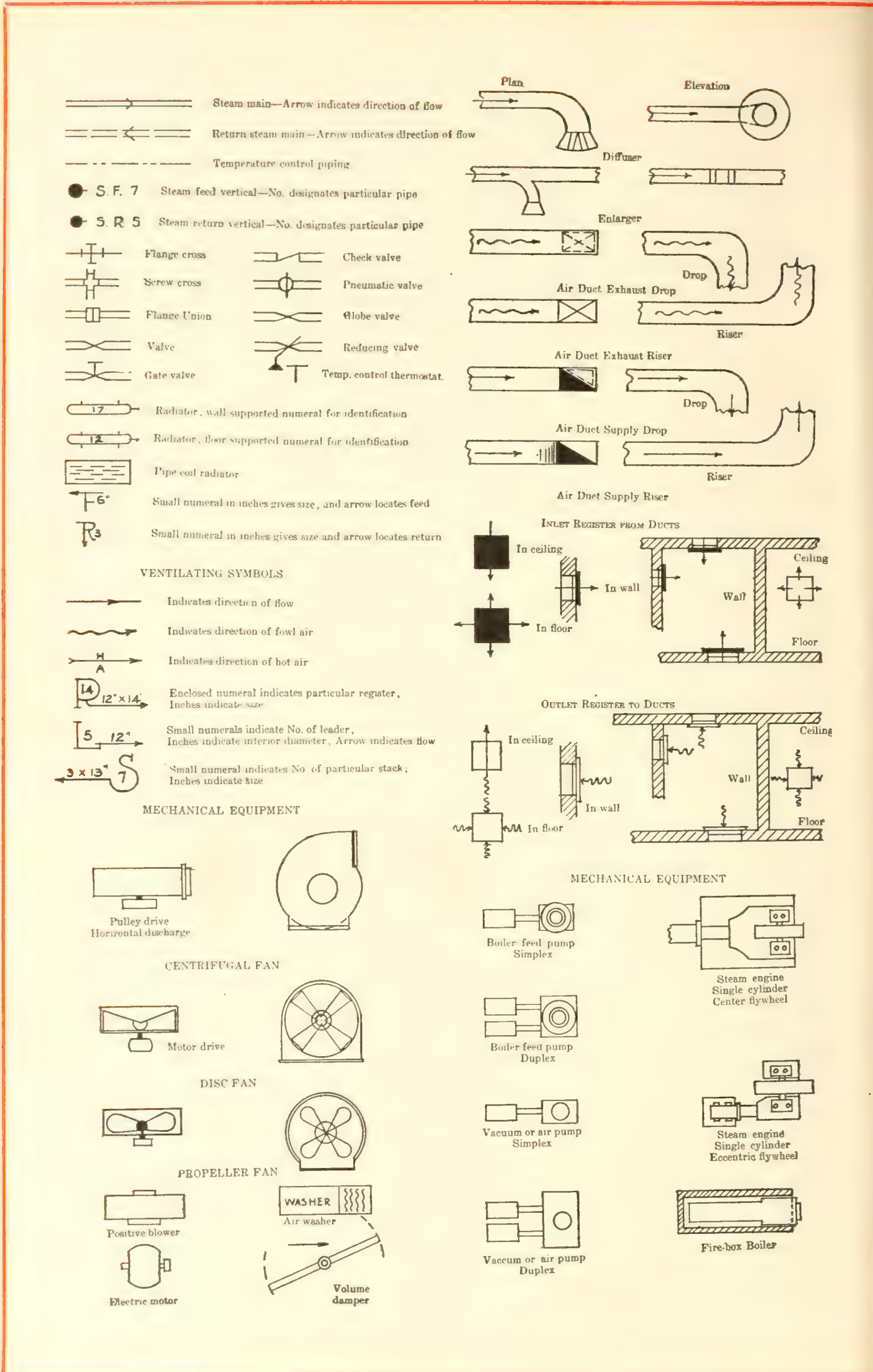
It is desirable that a key to the symbols used accompany all plans

If mains, feeders, branches and distribution panels are shown on the plans it is desirable that they be designated by letters or numbers.

Heights of center of wall outlets;
(unless otherwise specified)

Living rooms	5′-6″
Chambers	5′-0″
Offices	6′-0″
Corridors	6′-3″

Heights of Switches (unless otherwise specified) 4′-0″



Steam main—Arrow indicates direction of flow
Return steam main—Arrow indicates direction of flow
Temperature control piping
S. F. 7
Steam feed vertical—No. designates particular pipe
S. R 5
Steam return vertical—No. designates particular pipe
Flange cross
Screw cross
Flange Union
Valve
Gate valve
Check valve
Pneumatic valve
Globe valve
Reducing valve
Temp. control thermostat
17
Radiator, wall supported numeral for identification
12
Radiator, floor supported numeral for identification
Pipe coil radiator
6"
Small numeral in inches gives size, and arrow locates feed
R3
Small numeral in inches gives size and arrow locates return
VENTILATING SYMBOLS
Indicates direction of flow
Indicates direction of fowl air
H
A
Indicates direction of hot air
14
12"×14"
Enclosed numeral indicates particular register,
Inches indicate size
5
12"
Small numerals indicate No. of leader,
Inches indicate interior diameter, Arrow indicates flow
3 x 13"
S
7
Small numeral indicates No. of particular stack;
Inches indicate size
MECHANICAL EQUIPMENT
Pulley drive
Horizontal discharge
CENTRIFUGAL FAN
Motor drive
DISC FAN
PROPELLER FAN
Positive blower
WASHER
Air washer
Electric motor
Volume damper
Plan
Elevation
Diffuser
Enlarger
Drop
Air Duct Exhaust Drop
Riser
Air Duct Exhaust Riser
Drop
Air Duct Supply Drop
Riser
Air Duct Supply Riser
INLET REGISTER FROM DUCTS
In ceiling
In wall
In floor
Ceiling
Wall
Floor
OUTLET REGISTER TO DUCTS
In ceiling
In wall
In floor
Ceiling
Wall
Floor
MECHANICAL EQUIPMENT
Boiler feed pump
Simplex
Steam engine
Single cylinder
Center flywheel
Boiler feed pump
Duplex
Vacuum or air pump
Simplex
Steam engine
Single cylinder
Eccentric flywheel
Vaccum or air pump
Duplex
Fire-box Boiler

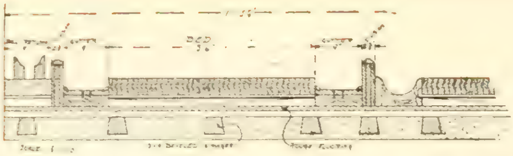
TABLE OF TREADS AND RISERS

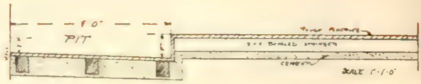
No. of Treads.	6 Inch Rise. ft. in.	6¼ Inch Rise. ft. in.	6½ Inch Rise. ft. in.	6¾ Inch Rise. ft. in.	7 Inch Rise. ft. in.	7⅛ Inch Rise. ft. in.	7¼ Inch Rise. ft. in.	7⅜ Inch Rise. ft. in.	7½ Inch Rise. ft. in.	7⅝ Inch Rise. ft. in.	7¾ Inch Rise. ft. in.
1	6	6¼	6½	6¾	7	7⅛	7¼	7⅜	7½	7⅝	7¾
2	1 0	1 0½	1 1	1 1½	1 2	1 2¼	1 2½	1 2¾	1 3	1 3¼	1 3½
3	1 6	1 6¾	1 7½	1 8¼	1 9	1 9⅜	1 9¾	1 10⅛	1 10½	1 10⅞	1 11¼
4	2 0	2 1	2 2	2 3	2 4	2 4½	2 5	2 5½	2 6	2 6½	2 7
5	2 6	2 7¼	2 8½	2 9¾	2 11	2 11⅝	3 0¼	3 0⅞	3 1½	3 2⅛	3 2¾
6	3 0	3 1½	3 3	3 4½	3 6	3 6¾	3 7½	3 8¼	3 9	3 9¾	3 10½
7	3 6	3 7¾	3 9½	3 11¼	4 1	4 1⅞	4 2¾	4 3⅝	4 4½	4 5⅜	4 6¼
8	4 0	4 2	4 4	4 6	4 8	4 9	4 10	4 11	5 0	5 1	5 2
9	4 6	4 8¼	4 10½	5 0¾	5 3	5 4⅛	5 5¼	5 6⅜	5 7½	5 8⅝	5 9¾
10	5 0	5 2½	5 5	5 7½	5 10	5 11¼	6 0½	6 1¾	6 3	6 4¼	6 5½
11	5 6	5 8¾	5 11½	6 2¼	6 5	6 6⅜	6 7¾	6 9⅛	6 10½	6 11⅞	7 1¼
12	6 0	6 3	6 6	6 9	7 0	7 1½	7 3	7 4½	7 6	7 7½	7 9
13	6 6	6 9¼	7 0½	7 3¾	7 7	7 8⅝	7 10¼	7 11⅞	8 1½	8 3⅛	8 4¾
14	7 0	7 3½	7 7	7 10½	8 2	8 3¾	8 5½	8 7¼	8 9	8 10¾	9 0½
15	7 6	7 9¾	8 1½	8 5¼	8 9	8 10⅞	9 0¾	9 2⅝	9 4½	9 6⅜	9 8¼
16	8 0	8 4	8 8	9 0	9 4	9 6	9 8	9 10	10 0	10 2	10 4
17	8 6	8 10¼	9 2½	9 6¾	9 11	10 1⅛	10 3¼	10 5⅜	10 7½	10 9⅝	10 11¾
18	9 0	9 4½	9 9	10 1½	10 6	10 8¼	10 10½	11 0¾	11 3	11 5¼	11 7½
19	9 6	9 10¾	10 3½	10 8¼	11 1	11 3⅜	11 5¾	11 8⅛	11 10½	12 0⅞	12 3¼
20	10 0	10 5	10 10	11 3	11 8	11 10½	12 1	12 3½	12 6	12 8½	12 11
21	10 6	10 11¼	11 4½	11 9¾	12 3	12 5⅝	12 8¼	12 10⅞	13 1½	13 4⅛	13 6¾
22	11 0	11 5½	11 11	12 4½	12 10	13 0¾	13 3½	13 6¼	13 9	13 11¾	14 2½
23	11 6	11 11¾	12 5½	12 11¼	13 5	13 7⅞	13 10¾	14 1⅝	14 4½	14 7⅜	14 10¼
24	12 0	12 6	13 0	13 6	14 0	14 3	14 6	14 9	15 0	15 3	15 6
25	12 6	13 0¼	13 6½	14 0¾	14 7	14 10⅛	15 1¼	15 4⅜	15 7½	15 10⅝	16 1¾
26	13 0	13 6½	14 1	14 7½	15 2	15 5¼	15 8½	15 11¾	16 3	16 6¼	16 9½
27	13 6	14 0¾	14 7½	15 2¼	15 9	16 0⅛	16 3¾	16 7⅛	16 10½	17 1⅞	17 5¼
28	14 0	14 7	15 2	15 9	16 4	16 7½	16 11	17 2½	17 6	17 9½	18 1
29	14 6	15 1¼	15 8½	16 3¾	16 11	17 2⅝	17 6¼	17 9⅞	18 1½	18 5⅛	18 8¾
30	15 0	15 7½	16 3	16 10½	17 6	17 9¾	18 1½	18 5¼	18 9	19 0¾	19 4½

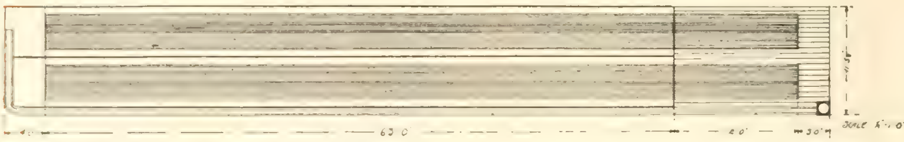
No. of Treads.	7⅞ Inch Rise. ft. in.	8 Inch Rise. ft. in.	8¼ Inch Rise. ft. in.	8½ Inch Rise. ft. in.	9 Inch Rise. ft. in.	9½ Inch Rise. ft. in.	10 Inch Rise. ft. in.	10½ Inch Rise. ft. in.	11 Inch Rise. ft. in.	13 Inch Rise. ft. in.	14 Inch Rise. ft. in.
1	7⅞	8	8¼	8½	9	9½	10	10½	11	1 1	1 2
2	1 3¾	1 4	1 4½	1 5	1 6	1 7	1 8	1 9	1 10	2 2	2 4
3	1 11⅝	2 0	2 0¾	2 1½	2 3	2 4½	2 6	2 7½	2 9	3 3	3 6
4	2 7½	2 8	2 9	2 10	3 0	3 2	3 4	3 6	3 8	4 4	4 8
5	3 3⅜	3 4	3 5¼	3 6½	3 9	3 11½	4 2	4 4½	4 7	5 5	5 10
6	3 11¼	4 0	4 1½	4 3	4 6	4 9	5 0	5 3	5 6	6 6	7 0
7	4 7⅛	4 8	4 9¾	4 11½	5 3	5 6½	5 10	6 1½	6 5	7 7	8 2
8	5 3	5 4	5 6	5 8	6 0	6 4	6 8	7 0	7 4	8 8	9 4
9	5 10⅞	6 0	6 2¼	6 4½	6 9	7 1½	7 6	7 10½	8 3	9 9	10 6
10	6 6¾	6 8	6 10½	7 1	7 6	7 11	8 4	8 9	9 2	10 10	11 8
11	7 2⅝	7 4	7 6¾	7 9½	8 3	8 8½	9 2	9 7½	10 1	11 11	12 10
12	7 10½	8 0	8 3	8 6	9 0	9 6	10 0	10 6	11 0	13 0	14 0
13	8 6⅜	8 8	8 11¼	9 2½	9 9	10 3½	10 10	11 4½	11 11	14 1	15 2
14	9 2¼	9 4	9 7½	9 11	10 6	11 1	11 8	12 3	12 10	15 2	16 4
15	9 10⅛	10 0	10 3¾	10 7½	11 3	11 10½	12 6	13 1½	13 9	16 3	17 6
16	10 6	10 8	11 0	11 4	12 0	12 8	13 4	14 0	14 8	17 4	18 8
17	11 1⅞	11 4	11 8¼	12 0½	12 9	13 5½	14 2	14 10½	15 7	18 5	19 10
18	11 9¾	12 0	12 4½	12 9	13 6	14 3	15 0	15 9	16 6	19 6	21 0
19	12 5⅝	12 8	13 0¾	13 5½	14 3	15 0½	15 10	16 7¼	17 5	20 7	22 2
20	13 1½	13 4	13 9	14 2	15 0	15 10	16 8	17 6	18 4	21 8	23 4
21	13 9⅜	14 0	14 5¼	14 10½	15 9	16 7½	17 6	18 4½	19 3	22 9	24 6
22	14 5¼	14 8	15 1½	15 7	16 6	17 5	18 4	19 3	20 2	23 10	25 8
23	15 1⅛	15 4	15 9¾	16 3½	17 3	18 2½	19 2	20 1½	21 1	24 11	26 10
24	15 9	16 0	16 6	17 0	18 0	19 0	20 0	21 0	22 0	26 0	28 0
25	16 4⅞	16 8	17 2¼	17 8½	18 9	19 9½	20 10	21 10½	22 11	27 1	29 2
26	17 0¾	17 4	17 10½	18 5	19 6	20 7	21 8	22 9	23 10	28 2	30 4
27	17 8⅝	18 0	18 6¾	19 1½	20 3	21 4½	22 6	23 7½	24 9	29 3	31 6
28	18 4½	18 8	19 3	19 10	21 0	22 2	23 4	24 6	25 8	30 4	32 8
29	19 0⅜	19 4	19 11¼	20 6½	21 9	22 11½	24 2	25 4½	26 7	31 5	33 10
30	19 8¼	20 0	20 7½	21 3	22 6	23 9	25 0	26 3	27 6	32 6	35 0

RULE FOR CACULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISERS OF STAIRS.

Subtract the width of tread from 25 in. and the result will be twice the height of the riser. Thus: if the tread is 10 in. wide, then 25 — 10 = 15 ÷ 2 = 7½ in., the height of riser proportionate to a 10-inch tread. This is exclusive of nosings.







SPACE OCCUPIED BY AUTOMOBILES.

Touring Cars.

Length, 13 ft. 6 in. to 20 ft.
Height, 7 ft. 3 in.
Width, 6 ft. 0 in.

Smallest practical door, 8 ft. 0 in. high by 8 ft. 0 in. wide. Alley door should be not less than 11 ft. 4 in. and should be set not less than 22 ft. from opposite side.

Heavy Trucks.

Length, 15 ft. to 26 ft.
Width, 6 ft. 0 in.
Height, 10 ft. 0 in.

Width on floor between wheel pockets, 48 in. Length of wheel pocket, 34 in.

Smallest practical door, 9 ft. 0 in. wide by 11 ft. 0 in. high; for largest trucks, 13 ft. 6 in. high.

Doors to alley should not be less than 12 ft. wide and should be set not less than 28 ft. from opposite side of alley.

Moving Vans.

Length, 13 ft. to 16 ft. 6 in.
Width, 7 ft. to 8 ft. 2 in.
Height, 10 ft. to 12 ft.

Smallest practical door 10 ft. 0 in. wide by 13 ft. 6 in. high.

CLEARANCE UNDER OLD ELEVATED RAILWAY STRUCTURES AND TROLLEY WIRES, 12 FT. 0 IN.

Clearance required by the city for steam roads, 13 ft. 6 in.

Architects will be perfectly safe in making the maximum limit of door heights for any sort of vehicle 13 ft. 6 in., standard subway height, as no vehicle can be used commercially on the streets of Chicago that will not clear steam road viaducts. They might go around elevated viaducts, but they can not go around steam road viaducts and there is a probability that any future elevated viaducts would be raised to the city standard height of 13 ft. 6 in.

FURNITURE DIMENSIONS. FILE 82794

Chairs—Height of seat, 18″; depth of seat, 19″; top of back, 38″; arms, 9″ above seat.

Lounge—6′ long, 30″ wide.

Tables—Writing, height, 2′-5″; sideboards, height, 3′-0″; general height, 2′-6″.

Note—The smallest size practical for knee holes, 2′ high by 1′-8″ wide.

Beds—Single, width, 3′ to 4′; ¾ bed, width, 4′; double bed, width, 4′-6″ to 5′-0″, length 6′-6″ to 6′-8″; standard double bed, 4′-6″ x 6′-6″; footboards, 2′-6″ to 3′-6″ high; headboards, 5′ to 6′-6″.

Bureaus—Common, width, 3′-5″ or 4′; depth, 1′-6″ or 1′-8″; height, 2′-6″ or 3′.

Commodes—Top, 1′-6″ square and 2′-6″ high.

Chiffoniers—3′ wide, 1′-8″ deep, 4′-4″ high.

Cheval Glasses—Height, 6′-4″ or 5′-0″ or 5′-2″; width, 3′-2″ or 2′-6″ or 1′-8″.

Washstands—Length, 3′-0″; width, 1′-6″; height, 2′-7″.

Wardrobes—Length, 4′-6″—3′-0″; depth, 2′-0″—1′-5″; height, 8′-0″.

Sideboards—Length, 5′ to 6′; depth, 2′-2″.

Pianos—Upright, length, 4′-10″ to 5′-6″; height, 4′-4″ to 4′-9″; depth, 2′-4″. Square, length, 6′-8″; depth, 3′-4″.

Billiard Tables—4′-8″, 4½″ x 9, 5′ x 10. Must have 16′ x 20′ space.

Wardrobe Shelves—5′-10″ high.

Coat Hooks—5′-6″ high.

Flour Barrel—28″ to 30″ high and 20″ to 21″ dia.

DATA ON BUILDINGS WITH SIDINGS.

Clearance from face of building to center of track, 7′-0″.

Height of loading decks:
For shipping, 4′-0″.
For receiving, 3′-0″.

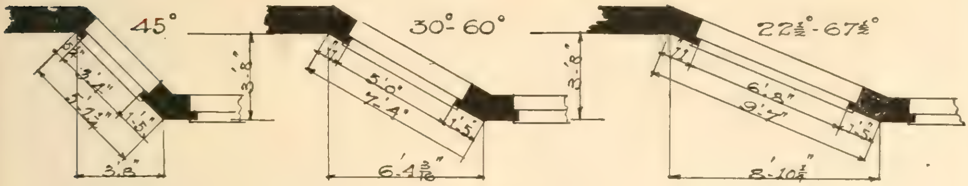
Clearance from center of track to edges of loading decks:
Upper edge, 7′-0″.
Lower edge, 5′-0″.

FILE 72

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.	Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
5	10	7′ 4″	11′ 6″	12′ 6″	20	21	12′ 9″	15′ 6″	17′
7	11	8′	11′ 6″	12′ 6″	22	22	13′ 4″	15′ 6″	17′
8	12	8′	12′ 6″	12′ 6″	23	23	13′ 6″	15′ 6″	17′
10	13	8′ 7″	12′ 6″	12′ 6″	25	24	14′	15′ 6″	17′
11	14	9′ 3″	12′ 6″	12′ 6″	26	25	14′ 6″	15′ 6″	17′
13	16	10′ 5″	12′ 6″	12′ 6″	28	26	14′ 6″	15′ 6″	17′
14	17	11′	14′ 8″	17′	29	27	14′ 6″	16′ 4″	17′ 6″
16	18	11′ 7″	14′ 8″	17′	31	28	15′	16′ 4″	17′ 6″
17	19	12′ 2″	14′ 8″	17′	32	29	15′ 6″	16′ 4″	17′ 6″
19	20	12′ 9″	14′ 8″	17′	34	30	15′ 6″	17′	17′ 6″

Add 40″ more from Front Line of Case for Keydesk Pedals and Seat.

TABLE SHOWING THE LENGTH OF SIDES OF BAYS ANGLE BEING 45, 30-60 AND 22½-67½ DEGREES.



Examples.

Angle of 45 Degrees.

1	ft.	6	in.	by	1	ft.	6	in.	2	ft.	1 7/16	in.
1	“	7	“	“	1	“	7	“	2	“	2 7/8	“
1	“	8	“	“	1	“	8	“	2	“	4 1/4	“
1	“	9	“	“	1	“	9	“	2	“	5 11/16	“
1	“	10	“	“	1	“	10	“	2	“	7 1/8	“
1	“	11	“	“	1	“	11	“	2	“	8 1/2	“
2	“	0	“	“	2	“	0	“	2	“	9 15/16	“
2	“	1	“	“	2	“	1	“	2	“	11 3/8	“
2	“	2	“	“	2	“	2	“	3	“	0 3/4	“
2	“	3	“	“	2	“	3	“	3	“	2 3/16	“
2	“	4	“	“	2	“	4	“	3	“	3 5/8	“
2	“	5	“	“	2	“	5	“	3	“	5	“
2	“	6	“	“	2	“	6	“	3	“	6 7/16	“
2	“	7	“	“	2	“	7	“	3	“	7 7/8	“
2	“	8	“	“	2	“	8	“	3	“	9 1/4	“
2	“	9	“	“	2	“	9	“	3	“	10 11/16	“
2	ft.	10	in.	by	2	ft.	10	in.	4	ft.	0 1/16	in.
2	“	11	“	“	2	“	11	“	4	“	1 1/2	“
3	“	0	“	“	3	“	0	“	4	“	2 15/16	“
3	“	1	“	“	3	“	1	“	4	“	4 5/16	“
3	“	2	“	“	3	“	2	“	4	“	5 3/4	“
3	“	3	“	“	3	“	3	“	4	“	7 1/8	“
3	“	4	“	“	3	“	4	“	4	“	8 9/16	“
3	“	5	“	“	3	“	5	“	4	“	10	“
3	“	6	“	“	3	“	6	“	4	“	11 3/8	“
3	“	7	“	“	3	“	7	“	5	“	1 5/16	“
3	“	8	“	“	3	“	8	“	5	“	2 1/4	“
3	“	9	“	“	3	“	9	“	5	“	3 5/8	“
3	“	10	“	“	3	“	10	“	5	“	5 1/16	“
3	“	11	“	“	3	“	11	“	5	“	6 1/2	“
4	“	0	“	“	4	“	0	“	5	“	7 7/8	“

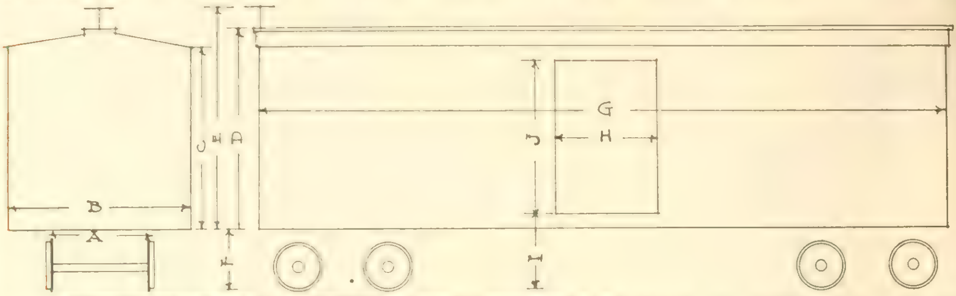
Angle of 30-60 Degrees.

1	ft.	6	in.	by	2	ft.	7 3/16	in.	3	ft.	0	in.
1	“	7	“	“	2	“	8 15/16	“	3	“	2	“
1	“	8	“	“	2	“	10 5/8	“	3	“	4	“
1	“	9	“	“	3	“	0 3/8	“	3	“	6	“
1	“	10	“	“	3	“	2 1/8	“	3	“	8	“
1	“	11	“	“	3	“	3 13/16	“	3	“	10	“
2	“	0	“	“	3	“	5 9/16	“	4	“	0	“
2	“	1	“	“	3	“	7 5/16	“	4	“	2	“
2	“	2	“	“	3	“	9 1/16	“	4	“	4	“
2	“	3	“	“	3	“	10 3/4	“	4	“	6	“
2	“	4	“	“	4	“	0 1/2	“	4	“	8	“
2	“	5	“	“	4	“	2 1/4	“	4	“	10	“
2	“	6	“	“	4	“	3 15/16	“	5	“	0	“
2	“	7	“	“	4	“	5 11/16	“	5	“	2	“
2	“	8	“	“	4	“	7 7/16	“	5	“	4	“
2	“	9	“	“	4	“	9 3/16	“	5	“	6	“
2	ft.	10	in.	by	4	ft.	10 7/8	in.	5	ft.	8	in.
2	“	11	“	“	5	“	0 5/8	“	5	“	10	“
3	“	0	“	“	5	“	2 3/8	“	6	“	0	“
3	“	1	“	“	5	“	4 1/16	“	6	“	2	“
3	“	2	“	“	5	“	5 13/16	“	6	“	4	“
3	“	3	“	“	5	“	7 9/16	“	6	“	6	“
3	“	4	“	“	5	“	9 5/16	“	6	“	8	“
3	“	5	“	“	5	“	11	“	6	“	10	“
3	“	6	“	“	6	“	0 3/4	“	7	“	0	“
3	“	7	“	“	6	“	2 1/2	“	7	“	2	“
3	“	8	“	“	6	“	4 3/16	“	7	“	4	“
3	“	9	“	“	6	“	5 15/16	“	7	“	6	“
3	“	10	“	“	6	“	7 11/16	“	7	“	8	“
3	“	11	“	“	6	“	9 7/16	“	7	“	10	“
4	“	0	“	“	6	“	11 1/8	“	8	“	0	“

Angle of 22½-67½ Degrees.

1	ft.	6	in.	by	3	ft.	7 7/16	in.	3	ft.	11	in.
1	“	7	“	“	3	“	9 7/8	“	4	“	1 5/8	“
1	“	8	“	“	4	“	0 5/16	“	4	“	4 5/16	“
1	“	9	“	“	4	“	2 11/16	“	4	“	6 7/8	“
1	“	10	“	“	4	“	5 1/8	“	4	“	9 1/2	“
1	“	11	“	“	4	“	7 1/2	“	5	“	0 1/8	“
2	“	0	“	“	4	“	9 15/16	“	5	“	2 11/16	“
2	“	1	“	“	5	“	0 3/8	“	5	“	5 3/8	“
2	“	2	“	“	5	“	2 3/4	“	5	“	7 15/16	“
2	“	3	“	“	5	“	5 3/16	“	5	“	10 9/16	“
2	“	4	“	“	5	“	7 5/8	“	6	“	1 3/16	“
2	“	5	“	“	5	“	10	“	6	“	3 3/4	“
2	“	6	“	“	6	“	0 7/16	“	6	“	6 3/8	“
2	“	7	“	“	6	“	2 13/16	“	6	“	9	“
2	“	8	“	“	6	“	5 1/4	“	6	“	11 5/8	“
2	“	9	“	“	6	“	7 11/16	“	7	“	2 1/4	“
2	ft.	10	in.	by	9	ft.	10 1/16	in.	7	ft.	4 13/16	in.
2	“	11	“	“	7	“	0 1/2	“	7	“	7 7/16	“
3	“	0	“	“	7	“	2 15/16	“	7	“	10 1/8	“
3	“	1	“	“	7	“	5 5/16	“	8	“	0 11/16	“
3	“	2	“	“	7	“	7 3/4	“	8	“	3 5/16	“
3	“	3	“	“	7	“	10 1/8	“	8	“	5	“
3	“	4	“	“	8	“	0 9/16	“	8	“	8 1/2	“
3	“	5	“	“	8	“	3	“	8	“	11 1/8	“
3	“	6	“	“	8	“	5 3/8	“	9	“	1 3/4	“
3	“	7	“	“	8	“	7 13/16	“	9	“	4 3/8	“
3	“	8	“	“	8	“	10 1/4	“	9	“	7	“
3	“	9	“	“	9	“	0 5/8	“	9	“	9 9/16	“
3	“	10	“	“	9	“	3 1/16	“	10	“	0 3/16	“
3	“	11	“	“	9	“	5 7/16	“	10	“	2 13/16	“
4	“	0	“	“	9	“	9 7/8	“	10	“	5 7/16	“

SIZES OF FREIGHT CARS AND LEGAL RAILWAY CLEARANCES



Car.	A	B	C	D	E	F	G	H	I	J
North-Western	59"	9'-0"	9'- 4"	10'- 4"	10'-10"	38"	34'- 0"	60"	49"	7'-6"
Chicago & Alton...........	"	9'-3"	9'- 0"	10'- 6"	11'- 0"	36"	40'- 6"	72"	48"	7'-8"
New York Central.........	"	9'-3"	9'- 2"	10'- 2"	10'-10"	42"	36'- 6"	72"	48"	8'-0"
Baltimore & Ohio..........	"	9'-4"	8'-10"	9'-10"	10'- 6"	37"	36'- 6"	72"	42"	7'-7"
Pacific Fruit Express......	"	9'-3"	9'- 0"	9'-10"	10'- 3"	40"	33'- 9"	48"	50"	6'-2"
North-Western Furniture..	"	9'-6"	10'- 6"	11'- 6"	12'- 0"	30"	50'- 6"	144"	40"	9'-8"
Cotton Belt................	"	9'-3"	9'- 6"	10'- 6"	11'- 6"	38"	36'- 6"	62"	48"	7'-8"
Chicago & Alton...........	"	9'-2"	8'- 8"	9'- 8"	10'-11"	37"	34'- 8"	66"	47"	6'-8"
North-Western	"	9'-4"	9'- 2"	10'- 2"	11'- 2"	39"	36'- 6"	60"	49"	7'-6"
North-Western	"	9'-2"	8'- 5"	9'- 6"	10'- 7"	36"	34'- 6"	60"	46"	6'10"
Erie	"	9'-6"	8'- 8"	9'- 8"	10'-10"	40"	34'-10"	62"	50"	6'10"

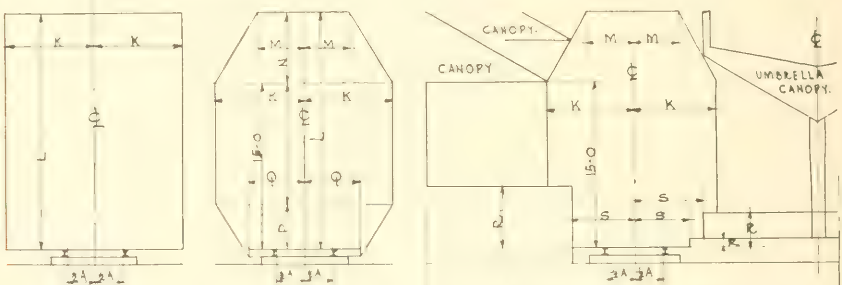


FIG-1 FIG-2 FIG-3 FIG-4

Fig. 1. **Buildings** and Miscellaneous Structures adjacent to Main Tracks, L = 21' 6", K = 8' 0"; Adjacent to Subsidiary Passenger Tracks L = 21' 6", K = 7' 6"; Tracks entering buildings L = car clearance (see diagram above for estimate), K = 7' 0".

Structures adjacent to Subsidiary Freight Tracks except as otherwise specified. Tracks outside buidings L = 21' 6", K = 8' 0"; Tracks entering buildings L = practical car clearance, K = 7' 0".

Fig. 2. **Bridges** supporting Main Tracks or Subsidiary Freight Tracks clearance shall be as follows: L = 21' 3", M = 4' 2", 0", P = 4' 0", Q = 5' 0". Bridges spanning Main Tracks or Subsidiary Freight Tracks Fig. 1. L = 21' 6", K = 8' 0".

Fig. 3. High Freight Platforms R = not to exceed 5' 8", S = not less than 5' 8" except when such platforms have S = not less than 8' 0".

Fig. 4. High Passenger Platforms on exclusive passenger tracks may have R = height of car floor above rail. Low passenger platforms R = 0' 8", S = not less than 5' 0".

Size of Swimming Tank.

FILE 726. 74

Swimming tanks that can be used for swimming contests must be exactly 20 yards in interior length, no less. (A tank ½ inch short would be ruled out of contest.) Eight yards wide is best, although 7 yards will pass; 4 feet deep at shallowest point and 8 feet deep at deepest point, which deepest point should be about 12 feet from end where springboard is placed. Depth at springboard end should be six feet. Interior of tank, both sides and bottom, should be white, and there should be three black lines on the bottom extending parallel with sides, and dividing the tank into four equal alleys; there should be a line across tank on bottom and up sides at exactly 2 yards from each end, measured horizontally, making lines exactly 16 yards apart horizontally.

Size of the Billiard Room, Gas Light, Etc.

The space required for the different sized tables is as follows:

For table 6 x 12, Room should be 16 x 22
For table 5½ x 11, Room should be 15½ x 21
For table 5 x 10, Room should be 15 x 20
For table 4½ x 9, Room should be 14 x 18½
For table 4 x 8, Room should be 13 x 17
For table 3½ x 7, Room should be 12½ x 16

The following directions for arranging the lights over billiard tables will be found useful. The distance of the light from the floor should be about 6 feet 2 inches. For a 5½ by 11 table, cross-arms 31 inches and long arms 62 inches. For a 5 by 10 table, the cross-arms of the pendant should measure, from light to light, 28 inches and the long arm 56 inches. For a 4½ by 9 table, cross-arms 25 inches and long arms 50 inches. For a 4 by 8 table, cross-arms 22 inches and long arms 44 inches.

Weight of Brickwork

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

9 inch wall	84 lb.
13 inch wall	121 lb.
18 inch wall	168 lb.
22 inch wall	205 lb.
26 inch wall	243 lb.

Measurement of Old Brick

Uncleaned rough from building dumped from 8 to 10 bricks per cubic foot, or average of 111 cubic feet to the M.

Uncleaned stacked on outside and interior of stack filled promiscuously 10-12 per cubic foot, or average of 91 cubic feet to the M.

Cleaned and closely stacked, 16 to 18 bricks per cubic foot, or actual average of 59 cubic feet to M. (Usually sold at 60 cubic feet to M to allow for waste and poor piling.)

Cleaned stacked on outside and interior filled promiscuously, 12 to 14 per cubic foot, or actual average of 77 cubic feet to M. (When sold from pile measure customary to count 80 cubic feet to M, to allow for waste and bats.)

Measurement of New Brickwork.

The Chicago Masons and Builders' Association have arbitrarily assumed that a cubic foot of wall contains 22½ common brick, or 7½ brick to the superficial foot of 4-inch wall and 15 brick to the superficial foot of 8-inch wall. These figures of the Masons' and Builders' Association are frequently used for the appraisal of party walls, etc., but if so used, the price per M for work in wall should be reduced accordingly.

The actual number of Chicago common brick required for a cubic foot of solid wall varies from 17½ to 19½, and masons in purchasing brick usually reserve 18 brick per cubic foot of solid wall; and when so doing, rarely find an excess or shortage at the end of construction. When the walls are divided into many small piers, requiring much cutting, and consequently much waste, it is best to figure 20 brick to the cubic foot.

On account of the wide variance of practice on the part of masons in estimating, architects, when calling for estimates on brick work by the thousand, will avoid useless controversy by stipulating that quantity of brick will be determined by superficial wall measurement according to the following rule, which is very nearly correct, as Chicago brick now run. Divide the total number of superficial feet of wall surface of a given thickness by 160, and multiply the result by the number of brick widths the wall is thick, and the result will equal the number of thousands of brick contained. A four-inch wall will contain 6¾ brick to the superficial foot, or 1,000 brick to 160 square feet.

Miscellaneous Masonry Data.

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1,296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

Cement Mortars. FILE 693.2

S. W. Curtiss, an authority on mortars, states that the only way lime mortar will set is by chemical combination with carbonic acid gas. In common practice this always comes from the atmosphere. Anything excluding air from lime mortar will prevent its setting; for this reason it is detrimental to lay imporous brick in lime mortar as such brick do not conduct air through same to the mortar joint and the only air that can come in contact with the mortar must pass through the mortar itself.

Cement mortar sets by crystallization, which means that in order to set cement must be supplied with water. In consequence cement mortar sometimes fails to set, or harden when used for laying porous brick because of the fact that capillarity draws all of the moisture out of the mortar into the brick and it does not have sufficient water for crystallization. Porous brick if laid in cement mortar should be thoroughly soaked so as to fill the pores and destroy the tendency to absorb moisture from the mortar. Nearly all stone products if ground fine enough will crystallize when mixed with water forming a cement of greater or less strength according to the character of the material and the fineness of the grinding. Calcareous matters or Portland cement which will not pass a 100 mesh sieve are incapable of crystallization and therefore valueless as a cementing material. The introduction of sand or stone products in cement not ground so as to pass 100 mesh reduces the amount of cementing material to the volume and at the same time increases its efficiency. A one hundred volume of neat cement that has a tensile strength of 700 pounds to the square inch will, when used with a four hundred volume of properly assorted gravel give a tensile strength of three hundred fifty pounds to the square inch. As there are five square inches the cement holds five times 350 or 1,750. Thus increasing the efficiency of the cement two and one-half times, and at the same time the proper proportion of graded gravels eliminate shrinking or swelling of the mass. While neat cement is stronger per cubic inch than the concrete, it is necessary in practical use to combine it with proper quantity of proper aggregates to avoid craze cracking from shrinkage. The smaller proportion of water in Portland cement making it workable gives the greatest strength. Neat Portland will take 22% of water to make it workable. This is an excess of water needed in the crystallization. In compressing it is impossible to compress the water, causing a shrinkage when crystallization takes place. When Portland cement is used with four volumes of aggregates 8% of the five volumes of water will make a workable material. This can be compressed without the danger of shrinkage. The cement attacks the silica of the aggregates, crystallizing into one mass. The introduction of quick lime into cement mortar means weakening the strength of the mortar way out of proportion to the amount of lime introduced. The effect is much worse than the introduction of an increased amount of sand except that the lime has a slightly retardative effect on the setting of the cement.

Hydrated lime in small quantities is probably less injurious than slacked lime. Cement has a tendency to prevent the setting of lime, by excluding the atmosphere, while lime has a tendency to prevent the setting of cement by absorbing moisture required for crystallization of the cement.

OVERLAYING CONSTRUCTION SHEET, SHINGLE AND COMPOSITION COVERING.

FILE 685.1

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If 4½ inches to the weather, 800; 5 inches, 720; 5½ inches, 655; 6 inches, 600.

Slating.

FILE 695.2

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 × 12	533	8 × 16	277	12 × 20	141
7 × 12	457	9 × 16	246	14 × 20	121
8 × 12	400	10 × 16	221	11 × 20	137
9 × 12	355	9 × 18	213	12 × 22	126
7 × 14	374	10 × 18	192	14 × 22	108
8 × 14	327	12 × 18	160	12 × 24	114
9 × 14	291	10 × 20	169	14 × 24	98
10 × 14	261	11 × 20	154	16 × 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

Thickness in inches........	⅛	3/16	¼	⅜	½
Weight in pounds..........	1.81	2.71	3.62	5.43	7.25

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

Tin Roofs.

FILE 695.4

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using ½-inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using ½-inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.

Gutters should have a fall of at least one inch in ten feet.

No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.

Joints to lead pipes require a pound of solder for every inch in diameter.

Capacity of Cisterns.

FILE 696

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.

5 feet in diameter holds 4.66 bbls.
6 feet in diameter holds 6.71 bbls.
7 feet in diameter holds 9.13 bbls.
8 feet in diameter holds 11.93 bbls.
9 feet in diameter holds 15.10 bbls.
10 feet in diameter holds 18.65 bbls.

SQUARE CISTERN.

5 feet by 5 feet holds 5.92 bbls.
6 feet by 6 feet holds 8.54 bbls.
7 feet by 7 feet holds 11.63 bbls.
8 feet by 8 feet holds 15.19 bbls.
9 feet by 9 feet holds 19.39 bbls.
10 feet by 10 feet holds 23.74 bbls.

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter	Outside Diameter	External Circumference. A	Length of Pipe per Sq Foot of Outside Surface.	Internal Area	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In	In.	Ft.	In.	In	Ft	Lbs.			Lbs.
⅛	40	1 272	9.44	012	129	2,500	.24	27	.0006	005
¼	.54	1.636	7.075	049	229	1,385.	42	18	.0026	021
⅜	67	2.121	5.657	110	358	751.5	.56	14	0057	.047
½	84	2 652	4.502	196	554	472.4	84	14	0102	085
¾	1 05	3 299	3 637	441	866	270.	1.12	11½	0230	190
1	1 31	4 134	2 903	785	1.357	166.9	1 67	11½	0408	.349
1¼	1 66	5.215	2 301	1 227	2 164	96.25	2.25	11½	0638	527
1½	1 9	5.969	2.01	1.767	2 835	70.65	2.69	11½	0918	760
2	2 37	7.461	1 611	3.141	4.330	42.36	3.66	8	1632	1.356
2½	2 87	9 032	1 328	4.908	6.491	30.11	5.77	8	2550	2.116
3	3 5	10 996	1 091	7.068	9.621	19.49	7.54	8	3673	3 049
3½	4	12.566	955	9 621	12 566	14.56	9 05	8	.4998	4 155
4	4 5	14 137	849	12.566	15.904	11.31	10.72	8	6528	5.405
4½	5.	15 708	765	15.904	19 635	9 03	12.49	8	8263	6.851
5	5.56	17 475	629	19 635	24.299	7 20	14.56	8	1.020	8.500
6	6 62	20 813	577	28 274	34.471	4 98	18 76	8	1 469	12.312
7	7.62	23 954	505	38 484	45.663	3.72	23 41	8	1.999	16.662
8	8 62	27.096	.444	50.265	58 426	2.88	28 34	8	2 611	21.750
9	9 68	30 433	394	63 617	73.715	2 26	34 67	8	3 300	27 500
10	10 75	33.772	355	78.540	90.792	1 80	40 64	8	4 081	34 000

* The Standard U S. gallon of 231 inches.

Divide the external circumference column, A, by 12 and the result will be the square feet of surface per lineal foot

Grade Per Mile.

The following table will show the grade per mile:
An inclination of

1 foot in 15 is 352 feet per mile.
1 foot in 20 is 264 feet per mile.
1 foot in 25 is 211 feet per mile.
1 foot in 30 is 176 feet per mile.
1 foot in 35 is 151 feet per mile.
1 foot in 40 is 132 feet per mile.
1 foot in 50 is 106 feet per mile.
1 foot in 100 is 53 feet per mile.
1 foot in 125 is 42 feet per mile.

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) in 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear	Thickness of Brickwork	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 0 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. Odor: Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. Taste: If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Capacity of Drain Pipe.

Size of Pipe.	Gallons per Minute.							
	½-in. Fall per 100 ft.	3-in. Fall per 100 ft.	6-in. Fall per 100 ft.	9-in. Fall per 100 ft.	12-in. Fall per 100 ft.	18-in. Fall per 100 ft.	24-in Fall per 100 ft.	36-in. Fall per 100 ft.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
Inches.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute
3..........	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4..........	1 in 92	96	1 in 40.8	144	1 in 23.	192	1 in 10.2	288
6..........	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9..........	1 in 207	495	1 in 92.	742.5	1 in 51.7	990	1 in 23	1,485

Transmission of Heat by Various Substances.

FILE 697.0

Window glass being	1,000	Brick (rough)	200 to 250
Oak or Walnut	66	Brick Whitewashed	200
White Pine	80	Granite or Slate	250
Pitch Pine	100	Sheet Iron	1,030 to 1,110
Lath and Plaster	75 to 100		

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

	Hot Water.			Steam.	
Temperature of radiating surface (radiators) Fahr	160°	180°	200°	227° 5 Lbs.	240° 10 Lbs.
	Square Feet of Glass to 1 Square Foot Radiator Surface.				
Temperature above surrounding air 90°	1.9	2.3	2.8	3.3	3.8
" " " " 80°	2.3	2.9	3.5	4.0	4.6
" " " " 70°	3.0	3.6	4.2	5.0	5.7
" " " " 60°	4.0	4.6	5.25	6.0	7.0
" " " " 50°	5.0	6.0	6.8	8.0	9.0
" " " " 40°	6.9	8.0	8.2	10.0	11.5

Formulae for Figuring Radiation for Factories.

A formula for figuring radiation which is used by some of the best heating engineers in determining the amount of radiation for factory buildings is as follows: $\frac{G}{3.3} + \frac{W}{10.9} + \frac{V}{171} =$ sq. ft. of radiation in which, $G =$ Glass Area.
$W =$ Net Wall Area.
$V =$ Volumn of air in the Room.

SIZE OF STANDARD FLUE LINING ON SALE ON THIS MARKET.

Outside size.	Inside size.	Inside area.
4¼ x 8½ in.	3⅛ x 7¼ in.	22.6 sq. in.
8½ x 8½ in.	7 x 7 in.	49 sq. in.
13 x 13 in.	11⅝ x 11⅝ in.	135 sq. in.
4½ x 13 in.	3⅛ x 11⅝ in.	36.5 sq. in.
8½ x 13 in.	6⅝ x 11⅝ in.	77 sq. in.
13 x 18 in.	11½ x 16¾ in.	193 sq. in.
8½ x 18 in.	6⅞ x 16½ in.	114 sq. in.
18 x 18 in.	15¾ x 15¾ in.	247 sq. in.

GENERAL RULE FOR BRICK STACKS.

Diameter of base should not be less than 1/10 of height if square, or round, 1/12 of height. Batter of stacks 3/100 of an inch to the foot in height. Thickness of brick work should be not less than one brick from top to 25 feet below same, changing to 1½ brick from 25 feet to 50 feet below top, increasing ½ brick in thickness for each succeeding 25 feet, measuring from the top downward.

Fireplace Flue Areas.

For three-story building, area at top of smoke chamber should be 1/12 of area of fireplace opening.

Two-story building area at top of smoke chamber should be 1/10 of area of fireplace opening.

One-story building area at top of smoke chamber should be ⅛ area of fireplace opening.

Throat of fireplace should never be less than 3 in. or more than 4½ in. by the width of fireplace opening.

Front edge of arch should never be thicker than one-half brick, approximately 4 in.

Splay of sides of flue from throat opening up to flue lining should be 2 in. to the foot. The raise from soffit or lintel, or from highest point or soffit to arch should be 6 in.

Proportion of Parts of Steam Heating Boilers.

FILE 697.43

FROM PROF. R. C. CARPENTER.

Radiating surface=square feet	250	500	750	1000	1500	2000	3000	4000	5000	7500	10000
Nominal horse-power	2.5	5.0	7.5	10.0	15.0	20.0	30.0	40.0	50.0	75.0	100.0
Ratio radiating to heating surface	4.5	5.1	5.4	5.6	6.0	6.2	6.7	6.9	7.0 / 9.0*	7.0 / 9.0*	7.0 / 9.0*
Probable evaporation per lb. coal	5.5	5.7	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Pounds of steam per sq. ft. grate (A)	55.0	57.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0
Pounds of steam per sq. ft. grate (B)	44.0	46.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Ratio radiating to grate surface (A)	165.0	171.0	180.0	195.0	210.0	225.0	240.0	255.0	270.0	285.0	300.0
Ratio radiating to grate surface (B)	132.0	138.0	144.0	156.0	168.0	180.0	192.0	204.0	216.0	228.0	240.0
Ratio heating to grate surface (A)	36.5	33.2	33.2	34.8	35.0	36.2	36.5	37.0	38.5	40.5 / 31.5*	42.5 / 33.3*
Ratio heating to grate surface (B)	28.5	27.0	26.7	27.7	28.0	29.0	29.3	29.6	30.8	32.2 / 25.2*	34.5 / 26.5*
Heating surface, square feet	55.0	98.0	138.0	178.0	250.0	322.0	447.0	580.0	710.0	1071 / 833*	1430 / 1111*
Grate surface, square feet (A)	1.52	2.92	4.15	5.68	7.15	8.9	12.4	15.7	18.5	26.5	33.3
Grate surface, square feet (B)	1.88	3.88	5.4	6.37	8.92	11.2	15.5	19.5	23.2	32.5	41.5
Diameter of safety valve, inches	1.5	2.25	2.50	2.75	3.0	3.25	3.5	4.2	4.0	2 of 3	2 of 4
Diameter of smoke flues, inches	7.0	10.0	11.2	12.0	15.0	17.0	19.0	23.0	25.0	28	3A
Square inches in above flues	38.5	78.5	95.0	113.0	176.7	227.0	283.5	415.5	490.9	615.7	907.9

*Water tube boilers.

A When rate of coal consumption is 10 pounds per hour each square foot grate surface.

B When rate of coal consumption is 8 pounds per hour each square foot grate surface.

THE ORDERS AND THEIR APPLICATION

By ALFRED W. S. CROSS, M. A., F. R. I. B. A., and ALAN E. MUNBY, M. A.

Introduction.

So many scholarly works upon the Orders are in existence, that some explanation seems to be called for in introducing another series of articles upon a subject that is, to all appearances, already well worn.

Notwithstanding the consensus of opinion as to the general proportions that ought to be followed in their delineation, an opinion based upon the rules laid down by the architects of an early period of the Renaissance, a surprising divergence from the precepts and practices of these old masters of their art is to be found in many buildings of our own time.

The writers are only aware of the existence of one book which seems to meet the usual office requirements, and that is a work entitled: "Rules for Drawing the Several Parts of Architecture," by James Gibbs, published in 1732; a book that has never been reprinted and copies of which are not now readily obtainable. The object aimed at, and successfully attained, is an illustration and description of an example of each Order, not "after Gibbs," but representing one of a good average type of design so proportioned that the dimensions of the various parts bear simple and easily discernible ratios one to another.

An attempt has been made to co-ordinate the leading features of the book by re-drawing some of the illustrations, retaining the useful dimensions shown thereon and entirely re-writing the description of the plates, with the introduction of some general principles likely to be of value to the draughtsman and student, for which purpose the opinions of standard writers, particularly those of Sir William Chambers, have been freely incorporated.

Before attempting such a condensation of the material in the book it was thought desirable to ascertain how far the generalizations adopted by Gibbs really represent the proportions used by acknowledged authorities. For this purpose the average ratio of the diameter of the column to the height of the entablature, as being a relation which essentially affects the whole proportion of the Order, was obtained by measuring a number of recognized examples, and it may be of interest to give the results, as an indication of the actual value of the dimensions used.

The result renders it evident that the general proportions of the Orders as recommended for adoption by this architect are fully worthy of confidence.

Hence, it would obviously seem preferable to master a few main dimensions, and, having thus inculcated a general sense of proportion, to rely upon gaining familiarity with the plates by constant use, when the proportions of the smaller members of the compositions will become naturally assimilated. The Composite Order is given in Gibbs' book, but, owing to its similarity to the Corinthian and to the absence of a consensus of opinion as to its dimensions, it has not been included in the present work.

No encroachments have been shown on any of the Orders to avoid distracting attention from the dimensions. With the exception of the whole of the Tuscan Order and of the frieze of the Ionic Order there are few members, apart from mere fillets, which have not been enriched, by some form of ornament, in one or another example, the Doric naturally the least and the Corinthian the most. In the latter Order, in fact, even the cyma and corona of the cornice, in addition to the frieze, ogees and beads, are often ornamented, but, apart from the question of expense, it is undesirable to carry such elaboration too far, as when placed in close contact with each other, especially when a distant view is alone possible, one moulding will often rob another of its effect, and, indeed, the value of richness of detail is more often than not lost in this manner.

The enrichment of columns beyond ordinary flutings is generally to be deprecated, while the application of ornament to bases and pedestals is seldom either requisite or desirable.

However great may be the utility of drawings dealing with the Orders, it should never be forgotten that they are merely a means to an end, that end being an executed building. Those whose work is confined to a drawing board develop a strong tendency to consider their compositions solely from an elevational and artistic draughtsman's point of view, and every opportunity should be taken of checking this habit and of cultivating the art of thinking "in the round." The study of perspective of buildings, and, best of all, the preparation of models of portions of a proposed building, an occupation which often results in the discovery of latent defects of design, are alike of the greatest educational value to the student of architecture.

TABLE SHOWING THE APPROXIMATE RATIO BETWEEN THE LOWER DIAMETER OF THE COLUMN AND THE HEIGHT OF THE ENTABLATURE.

Tuscan.	Doric.	Ionic.	Corinthian.
Alberti 1:1.5	Alberti 1:2.0	Alberti.........{1:1.4 / 1:1.7}	Alberti 1:1.8
Palladio 1:1.8	Palladio 1:1.9		Palladio 1:2.0
Scamozzi ...1:1.9	Scamozzi 1:2.1	Palladio 1:2.0	Scamozzi 2:2.0
Vignola 1:1.8	Vignola 1:2.0	Scamozzi 1:1.8	Vignola 1:2.5
—	Parthenon 1:2.0	Vignola 1:2.3	Pantheon 1:2.3
—	Baths, Diocletian 1:2.0	Fortuna (Rome).1:2.3	Jupiter Stator ...1:2.5
—	Temple Pæstum..1:1.7	Baths, Diocletian 1:1.9	Jupiter Tonans..1:2.2
—	Apollo, Delos ...1:1.8	Minerva, Athens.1:2.3	Temple Antonius 1:2.3
St. Paul's Convent Garden ...1:1.8	Bow Church, Portico 1:1.9	Illius, Athens....1:2.3	
		Banqueting Hall.1:2.0	Hampden Court..1:2.2
Average 1:1.76	Average 1:1.93	Average 1:2.00	Average 1:2.00
Gibbs 1:1.75	Gibbs 1:2.00	Gibbs 1:1.82	Gibbs 1:2.00

The above examples have not been selected with any intention of justifying the proportions adopted by Gibbs, but are merely cited as those which readily occurred to the mind, or of which the dimensions could be easily obtained.

THE SETTING UP OF AN ORDER.

(To be studied in connection with Plates I., II., III., IV. and V.)

The sequence followed in setting up an Order will be found to influence, to some extent, the rapidity and facility with which it can be accomplished. An outline of the method of procedure may, therefore, prove useful.

Usually the height of the Order is fixed by circumstances, as, for example, when it is to be applied to a given story of a building.

The total height having been settled, draw the limiting horizontal lines and then set out the vertical centre lines of the columns, thus dividing the frontage to be treated into bays appropriate to the exigencies of the design and having due regard to the correct intercolumniation of the Order adopted. If a pedestal is to be placed under the column, cut off one-fifth of the total height for it, and cut off one-fifth or one-sixth of the remainder (measured from the top limiting horizontal line) for the vertical height of the entablature; the intervening space gives the height of the column, including its cap and base. If no pedestal is to be used, divide the whole of the given height into five or six parts, cut off one of these parts, from the top, for the entablature, and the remainder gives the height of the column.

The Column. Since some of the dimensions of the entablature are in terms of the diameter of the column, the latter should be next developed. The term "diameter of the column" refers always to its greatest diameter—namely, that of the shaft just above the lower cincture. This dimension is one-seventh to one-tenth of the height between the soffit of the entablature and the top of the pedestal, or lower limit of the Order in the absence of a pedestal. If the centre lines of the piers do not represent the centres of the columns, as, for instance, when coupled columns are used, the centre line of one of the columns must now be decided upon and the diameter of the Order symmetrically disposed horizontally across it. A semi-diameter is then cut off, from the bottom of the column, for the height of the base, and it should be noticed that this—except in the Tuscan and alternative Doric Orders—does not include the fillet at the base of the shaft, the members above the upper torus being reckoned as part of the shaft, as are also the astragal and fillet below the necking of the capital of the column. The plinth and lower torus of the base project one-third and the upper torus one-fifth of a semi-diameter beyond the lower circumference of the shaft. The leading lines for the base having thus been obtained, cut off by a horizontal line the height of the capital from the top of the column, and (except in the Ionic Order) again below it, a height equal to one-sixth of a semi-diameter for the astragal and fillet below the necking.

The semi-diameter of the shaft at one-third of its height from the bottom is then divided into five or six parts, and four or five of these parts are taken as a semi-diameter at the top, below the astragal. The shaft may now be completed, the entasis being usually made to start from the greater diameter, one-third up the shaft, below which point it is a true cylinder until the cincture at the base is reached. This is the best method to adopt in the case of small scale drawings. Where large detailed drawings are in question the diameter may be alternatively divided at the base of the shaft instead of at one-third of its height, and the entasis extended throughout the whole length. The completion of the shaft enables the projection of the capital to be marked off, and also that of the astragal and fillet, which is equal to their combined height.

The Entablature. The development of the entablature can now be proceeded with, the architrave, frieze and cornice being ruled off horizontally and the members of each inserted (see dimensions). The projections for a returned end or section are obtained from the upper diameter of the shaft. The lowest member of the architrave, and also the frieze, lie vertically over the circumference of this upper end of the shaft. The projection of the cornice beyond the frieze line is equal to its height, except in the Doric Order, in which the projection is one-third more than its height of one diameter. Further rules dealing with minor projections and the position of the modillions, dentils, etc., will be supplied by a study of the plates and tabulated dimensions.

Pedestal. Finally, the pedestal, if any, should be divided vertically into four parts; the lower part is ruled off for the height of the plinth, one-third of the second part for the height of the base, and one-half of the top part for that of the cap. The projection of the die is equal to that of the base of the column, and the plinth and the cap of the pedestal extends beyond this for a distance equal to the height of the base of the pedestal previously obtained.

The above dimensions will all be found in the subjoined table, which represents an endeavour to bring together, in a form suitable for reference, sufficient information to make any glaring disproportion impossible.

A few of the minor divisions are only approximations; they will, however, be found to be sufficiently accurate for any but large detail drawings, in which it is not desirable to destroy all individuality by rigorous mechanical rules.

On the left hand will be found the dimension required and, in the intermediate column the fraction for each Order of the previously ascertained unit given in the right-hand column.

Plate I.

Plate I. represents the four Orders drawn to a common vertical height.

The pedestal may or may not be required and, if used, it is to be regarded as an addition to the Order, the relative dimensions of the parts of which are not altered by its removal or introduction.

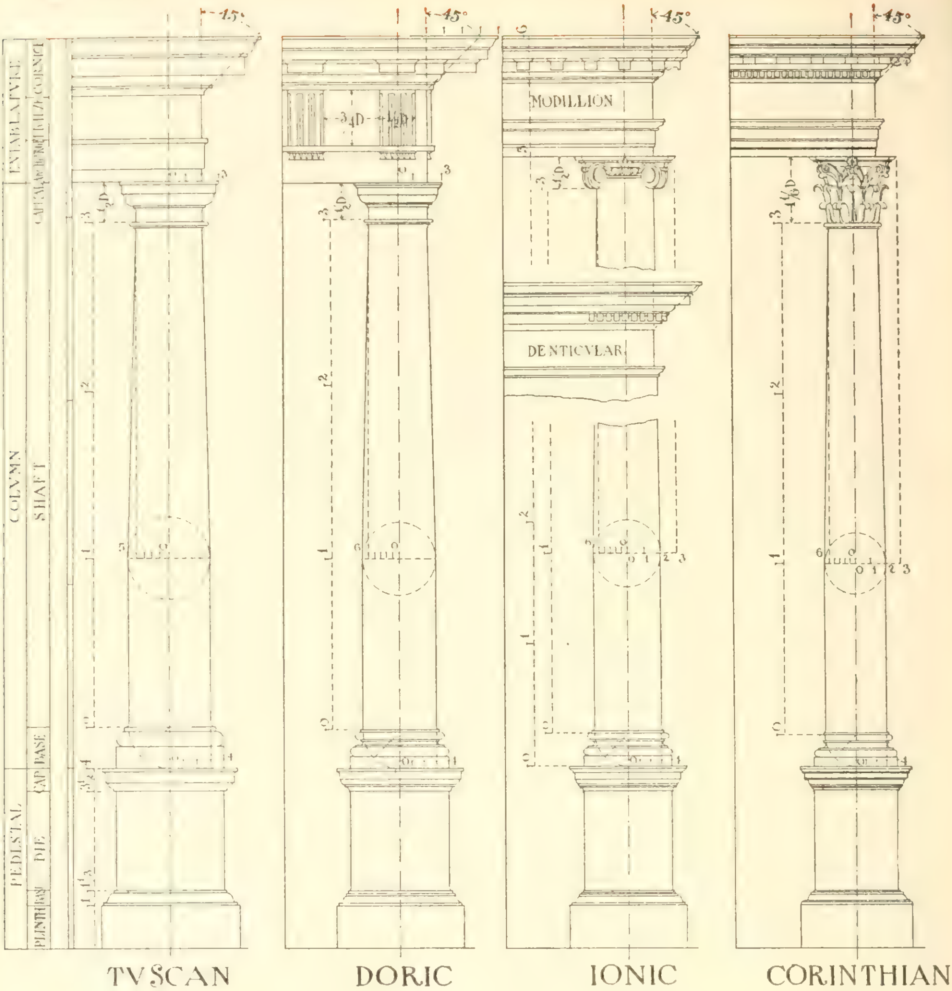
The diameter of the column (by which is meant the diameter of the shaft following its lower cincture) is the ruling dimension from which most of the others are obtained, and the smaller circumference of the top of the shaft always coincides with the frieze line from which all the projections of the entablature are set out.

In judging the value of such projections it should be borne in mind that in execution the higher vertical faces of the composition will usually be much foreshortened to the observer and that there will be a consequent increase in the comparative value of neighboring projections.

A perusal of the table will indicate those dimensions which all the Orders have in common, but for convenience of reference they are further summarized thus:

Height of Pedestal, ⅕ total height of Order.

PLATE 1.



Height of Plinth, ¼ height of Pedestal.
Height of Pedestal Base, ⅓ height of Pedestal Plinth.
Height of Pedestal Cap, ½ height of Pedestal Plinth.
Projection of Cap and Plinth, ⅓ height of Pedestal Plinth.
Projection of Corona over Die, ¾ projection of Pedestal Cap.
Height of Column Base, ½ dameter of Column.
Projection of Base over Shaft, ⅓ semi-diameter of Column.

Pilasters. The general proportions allotted to the columns of the Orders apply also to pilasters, which may be regarded as columns square on plan, but almost universally deeply engaged. The projection of pilasters must be regulated by circumstances. If impost mouldings or other projections stop upon them, as on the inner wall of an arcade, these projections must be sufficient to take the mouldings, and if they line with engaged columns crowned by an entablature, they must have a projection similar to the columns, and therefore in such cases never less than a semi-diameter. Apart from these considerations, the projection should be about one-fourth of the diameter. Pilasters may be fluted or plain; if the former, the flutes should be, as far as possible, the same size as those of the adjoining columns, and always an odd number.

* * *

On plain faces 7 flutes (occasionally 9) are used, and therefore in the above case 4 flutes (or 5) would be employed on each side of the re-entering angle. The returned sides of pilasters should never be fluted unless the projection is as much as half of a diameter. The diameter assigned to a pilaster will be that of a column (if any) used in conjunction with it. The shaft may or may not be diminished.

If the pilaster stand alone it is best formed with the same top and bottom diameter, but if a column stand in front of it then it should be diminished to the same extent as the column. Entasis is not usually given to pilasters.

Unless columns and pilasters are monoliths the shafts should be built up of three drums and not two, as a central joint, unless exceptionally well executed, has a very disagreeable appearance.

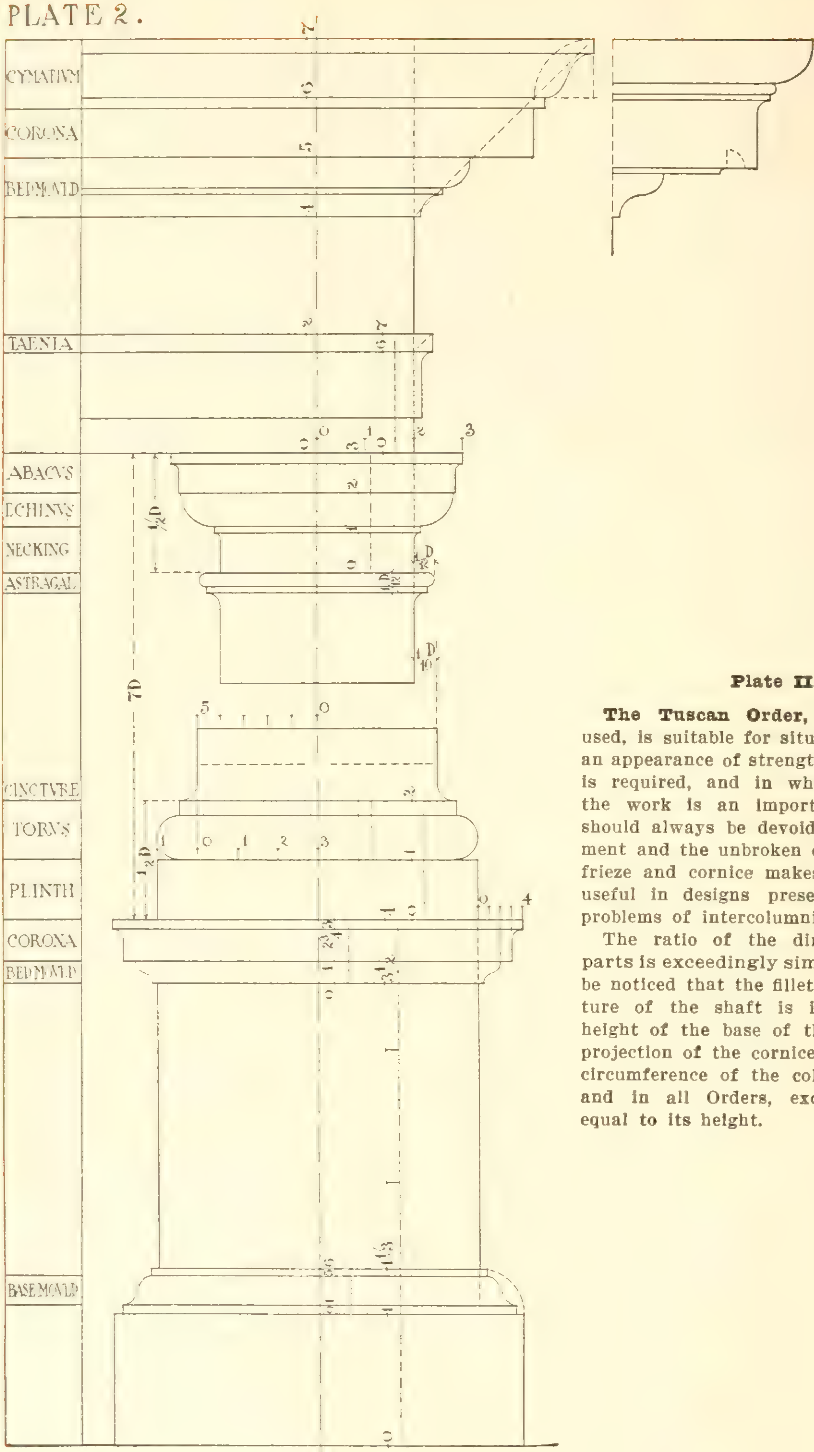
"Practical Notes for Architectural Draughtsmen: The Orders and their Application."

Tabulated Dimensions of the Orders. Arranged Progressively as Required for Use.

	Dimension required.	Tuscan.	Doric.	Ionic.	Corinthian.	Dimension = 1.
	No Pedestal — Height of Entablature	1/5	1/5	1/6	1/6	Total height of Order.
	With Pedestal, Height of Pedestal	1/6	1/5	1/5	1/5	" " "
	With Pedestal, Height of Entablature	1/5	1/5	1/6	1/6	Height of Order less Pedestal.
	THE COLUMN.					
Vertical.	Diameter of Shaft	1/7	1/8	1/9	1/10	Height of Order less Entablature and Pedestal.
Vertical.	Height of Base	1/2	1/2	1/2	1/2	Diameter of Shaft.
Vertical.	" Base Plinth	1/2	1/3	1/3	1/3	Height of Base.
Vertical.	" Lower Torus	3/4	3/8	3/8	3/10	" " less Plinth.
Vertical.	" Upper Torus	—	5/8	5/8	5/8	" lower Torus.
Vertical.	" Upper Torus and fillet under	—	1	1	1	" " "
Vertical.	" Capital	1/2	1/2	1/2	7/8	Diameter of Shaft.
Vertical.	" Necking	1/3	1/3	To eye 1/3	To 1st leaf about 1/3	Height of Capital (Corinthian less Abacus).
Vertical.	" Top of Neck to top of Ovolo	1/3	1/3	Eye to abacus 1/3	To 2nd leaf about 1/3	" " " " "
Vertical.	" Abacus	1/3	1/3	1/3	2nd leaf to abacus about 1/3	" " " " "
Vertical.	" Astragal and fillet	1/6	1/6	—	1/6	Semi-diameter of Shaft.
Vertical.	" Fillet below Astragal	1/3	1/3	—	1/3	Height of Astragal and Fillet.
Horizontal.	Projection of Base beyond Diameter	1/3	1/3	1/3	1/3	Semi-diameter of Shaft.
Horizontal.	" Upper Torus	—	1/5	1/5	1/6	" "
Horizontal.	Diminution of Shaft at Top	1/5	1/6	1/6	1/6	" "
Horizontal.	Projection of Cap over Shaft at Top	1/2	1/2	—	—	Semi-diameter of Shaft at Top.
Horizontal.	" Cap over Shaft at Base	—	—	1/2	1/2	Semi-diameter of Shaft.
Horizontal.	" Bead at top of Shaft	1/8	1/8	—	1/8	" "
	THE ENTABLATURE.					
Vertical.	Height of Architrave	2/7	3/8	3/10	3/10	Height of Entablature.
Vertical.	" Frieze	2/7	3/8	3/10	3/10	" "
Vertical.	" Cornice	3/7	3/8	4/10	4/10	" "
Vertical.	" Fillet and Cyma	1/3	2/9	Both fillets 1/4	Both fillets 1/5	" Cornice.
Vertical.	" Corona and Fillet over	1/3	2/9	1/4	1/5	" "
Vertical.	" Base of Corona to top of Ovolo	—	1/4	1/4	1/5	" "
Vertical.	" Top of Ovolo to Frieze	1/3	2/7	1/4	1/5	" "
Horizontal.	Total projection of Architrave over top diam. of Shaft	1/7	1/8	1/4	1/5	" Architrave.
Horizontal.	" top face of Architrave " "	1/5	3/8 (guttae)	1/3	[illegible]	Total projection of Architrave.
Horizontal.	" of Cornice over Frieze	1	4/5	1	1	Height of Cornice.
Horizontal.	" Inset of Corona from top of Cornice	1	5/6	1	1	" Fillet and Cyma of Cornice.
Horizontal.	" Length of Modillions (or Mutules)	—	1/2	1/4	(and ogee) 1/3	Diameter of Column.
Horizontal.	1/12 Breadth of Modillions (or Dentils)	—	(triglyph) 1/2	M 1/6 D. 1/12	1/6	" "
Horizontal.	1/24 Space between Modillions (or Dentils)	—	(metope) 3/4	M. 1/3 D. 1/24	—	" "
	THE PEDESTAL.					
Vertical.	Height of Plinth	1/4	1/4	1/4	1/4	Height of Pedestal.
Vertical.	" Base	1/3	1/3	1/3	1/5	" Plinth.
Vertical.	" Cyma of Base	2/3	1/2	1/2	(and fillet) 1/2	" Base.
Vertical.	" Fillet below Cyma	1	1	1	1	Fillet above Cyma.
Vertical.	" Cap	1/2	1/2	1/2	1/2	Height of Plinth.
Vertical.	" Base of Corona to top of Cap	2/3	1/2	1/2	1/2	" Cap.
Horizontal.	Projection of Cap and Plinth over Die	1	1	1	1	" Base of Pedestal.
Horizontal.	" Corona of Cap over Die	3/4	3/4	3/4	3/4	Projection of Cap over Die.

Note.—The "Diameter" is always the greatest diameter of the drum of the Column. M. refers to the Modillion Cornice. D. to the alternative Dentil Cornice.

PLATE 2.

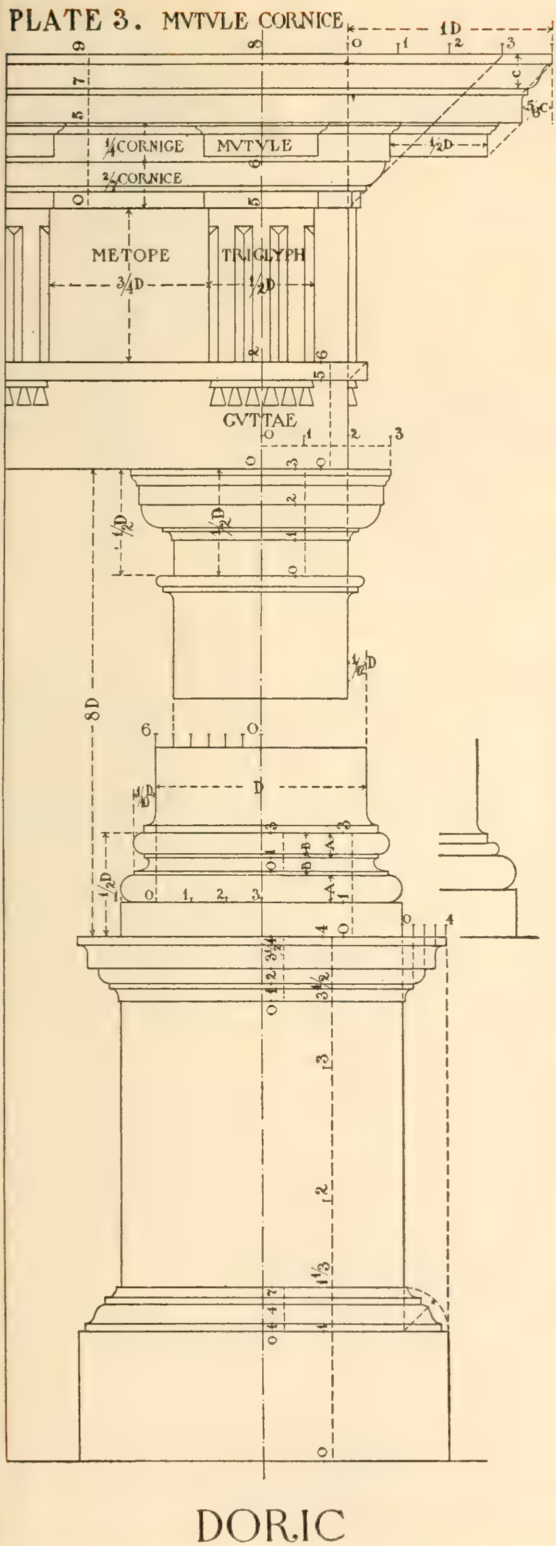


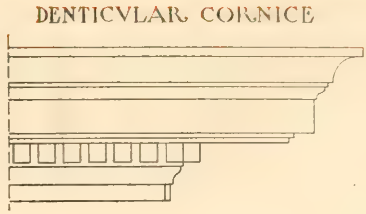
TVSCAN

Plate II.

The Tuscan Order, though seldom used, is suitable for situations in which an appearance of strength and simplicity is required, and in which the cost of the work is an important factor. It should always be devoid of any enrichment and the unbroken character of the frieze and cornice makes it particularly useful in designs presenting awkward problems of intercolumniation.

The ratio of the dimensions of its parts is exceedingly simple. It should be noticed that the fillet below the cincture of the shaft is included in the height of the base of this Order. The projection of the cornice over the upper circumference of the column is, in this and in all Orders, except the Doric, equal to its height.



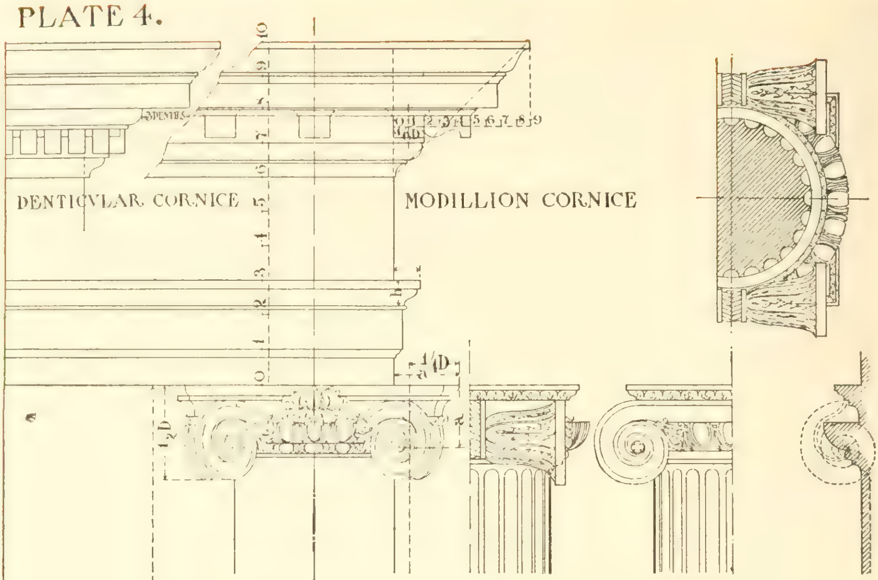


DORIC

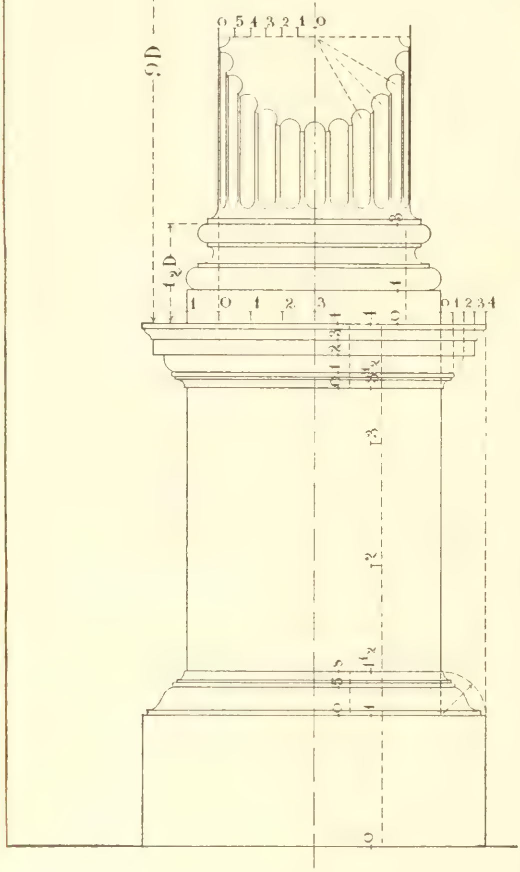
Plate III.

The Doric Order is always effective when used in lower storeys, arcades, and door and window openings, but owing to the triglyphs upon the frieze, which must fall centrally over the columns, it is the most difficult to deal with when spacing is in question.

The dimensions of the cornice do not lend themselves to any simple ratio and its projection is always greater than that adopted for the other Orders. The 45° line from the top of the frieze at once gives the bed mould of the mutule course, and one-third of the height of the cornice added to the top projection of this guiding line gives the total projection, while the mutules are one-half a diameter in side elevation. Some considerable modifications of the Order, as here represented, will be found to exist in many recognised examples. Occasionally the mutules are dispensed with, and their bed mould is cut to form a dentil course, as in the Theatre of Marcellus. The cyma crowning the cornice is often replaced by a cavetto, while the Doric base (shown alternatively on the plate) sometimes replaces the more graceful attic base. When this base is used, the upper fillet should be included in the height of the base, as in the Tuscan Order.



CVSHION CAPITAL



IONIC

Plate IV.

The Ionic Order shows smaller variations from the pure Classic examples than any other, and its proportions are fairly simple.

Two styles of cornices are, however, used, the modillion and the dentil cornice, and although the method adopted by Gibbs of giving prominence to the former has been followed, it should be stated that the latter is more generally found in old examples, whilst the former is preferred by Palladio.

Represented side by side upon the plate the extent of the variation is easily discernible. A modillion or dentil should always be bisected by the centre line of the column and the spacing determined by the distance of this line from the frieze, as set out upon the drawing. The frieze is always plain and in larger works it is, preferably, kept flat. In smaller compositions, however, when narrow or when used over doors and windows a pulvinated frieze may be adopted with good effect.

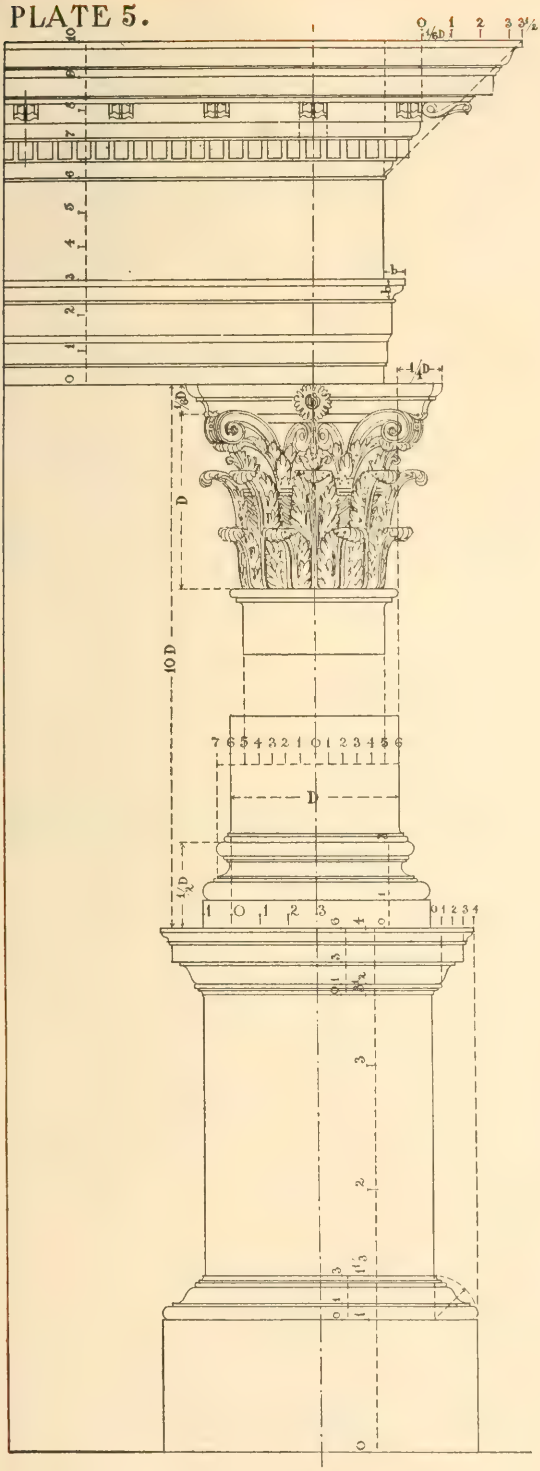
The earlier alternative form of the Ionic capital in which the faces of the volutes are parallel to the plane of the elevation (not shown upon the drawings) may, of course, be substituted for the capital with angle volutes at 45°, though the latter has usually a much more graceful effect, particularly in small compositions. Of course, the geometrical method for setting out the volutes cannot be used in drawing such capitals in ordinary elevation. It should be noticed that the height of the capital in this Order is measured from the soffit of the volutes.

The centre of the eye is one-third of the height of the capital from its bottom and is in elevation placed just outside the top circumference of the shaft, while the horizontal fillet at the top of the shaft is immediately below the eye.

When the column is fluted the width of the fillets should be one-fourth to one-third that of the flutes. The flutes generally number twenty or twenty-four; in the latter case the simple method of setting them out on plan, as shown on the drawing, will be found of service.

The attic base is always used with the Ionic Order.

PLATE 5.



CORINTHIAN

Plate V.

The Corinthian Order has been represented with considerable variations from the original type.

The Ionic entablature was often used by the ancients, supported by Corinthian columns, and the Corinthian cornice itself, though here represented with a dentil band, is often found without one. No general rule appears to exist for spacing the modillions or for their dimensions, the ratio of the width of the modillion to the space between two of them varying from 1 : 1½ to 1 : 2½, and again the number of the dentils between the modillions varies from 2 to 5 in different examples.

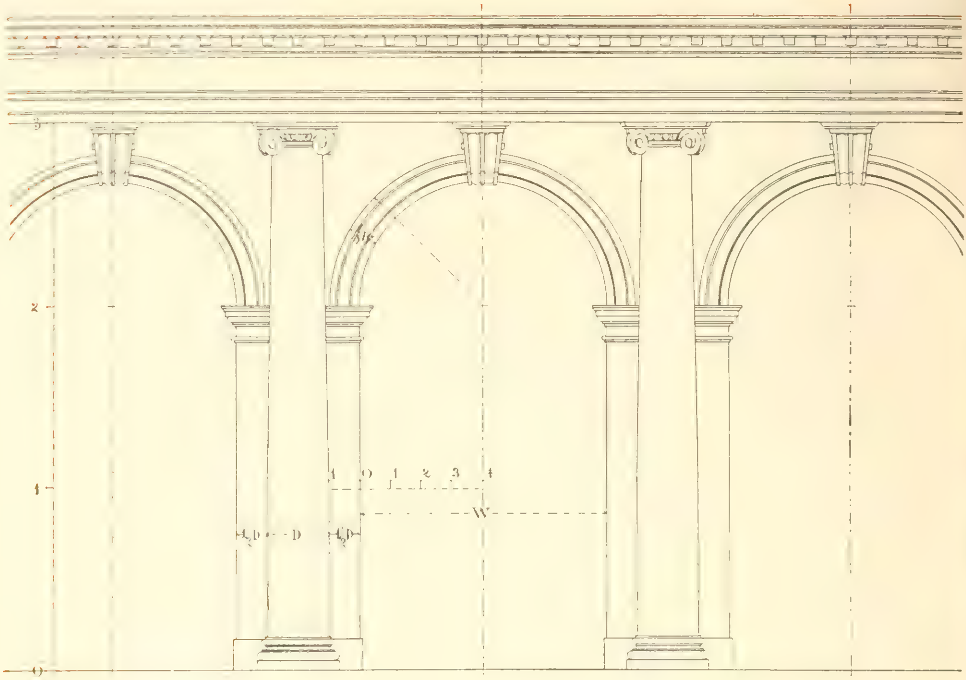
Both features should be symmetrically placed with reference to one another and to the centre line of the column, a point often neglected. To secure this result the following method is recommended:—Draw a modillion one-sixth of the diameter of the column in width, arranged symmetrically over the centre line of the column. Place another with its outside edge three and a half times its width within the total projection of the cornice, and thus obtain the spacing between the blocks. Divide the distance between two modillion centres into 15 parts, give two to a dentil, to be placed symmetrically under a modillion, and one to each space between the dentils, which will be found to bring the inside edge of the last dentil before the return, on the frieze line.

The form and projection of the leaves of the capital are largely matters of individual taste, but the general method of their arrangement will be evident after examining the drawing. It may, however, be noted that the eye of the volute is just outside the lower circumference of the shaft, and that the tiers of leaves divide the capital below the abacus into three approximate equal horizontal sections.

The column may or may not be fluted as in the Ionic Order.

The attic base, as used in the Ionic Order, is very generally employed—in fact, it is often preferable to adopt it, omitting the additional mouldings shown, for the sake of variety, on the drawing.

PLATE 6.



IONIC

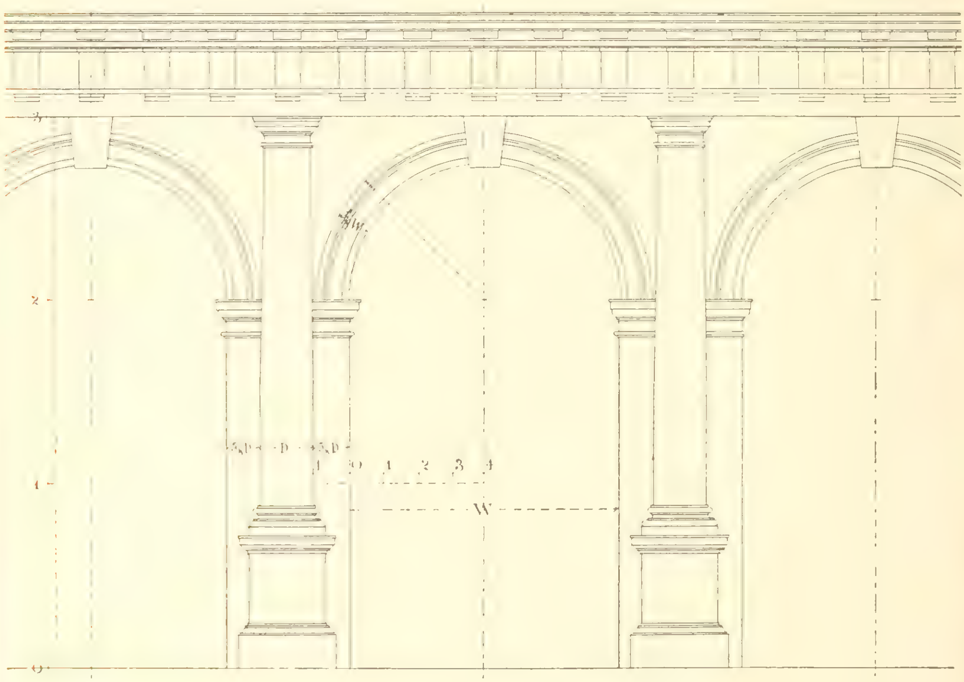


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Plate VI.

The relations and dimensions given in this and similar subsequent plates must, therefore, be looked upon as necessarily somewhat elastic. At the same time, such dimensions as are given should not be disregarded, but considered in the light of proportions to be attained as far as the exigencies of the plan will admit.

The spacing of arcading dealt with in this plate should be governed by the height of the space to be treated, and it will be found that the best effects are obtained when the widths of the openings approximate to half of their height, and when the total width of the piers lies between one-half and two-thirds of that of the opening.

The spacing must also be considered in reference to the Order employed, so that when triglyphs, or modillions, are placed centrally over the columns their proper spacing may be interfered with as little as possible. It will thus be seen that a relation exists between the diameter of the column, the width of the pilaster, and the width of the opening. Again, the diameter of the column relatively to the opening will be influenced by the presence, or absence, of a pedestal to the Order. The summary shown, collected from Gibbs's work, giving the dimensions to be aimed at in order to comply with the above relations, will be found useful:

The height of the impost should always be about two-thirds of the height from the ground to the soffit of the architrave of the Order, whether a pedestal is in use or not.

Diameter of Column = 1.

	Tuscan.		Doric.		Ionic.		Corinthian.	
	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.
Width of bay centre to center	6	7	6¼	7½	6	7½	6 5-12	8⅛
Width of one pilaster	½	⅔	½	⅝	½	⅝	9/16	7-10
Width of opening	4	4⅔	4¼	5¼	4	5¼	4⅓	5⅗

The archivolt or moulding running round the arch should be the same width as the pilaster (less any necessary clearance for the mouldings)—that is, about one-eighth of the width of the opening, which should also be the height of the impost cap to the bottom of the necking. Further details as to the members will be found on Plate VII.

PLATE 7.

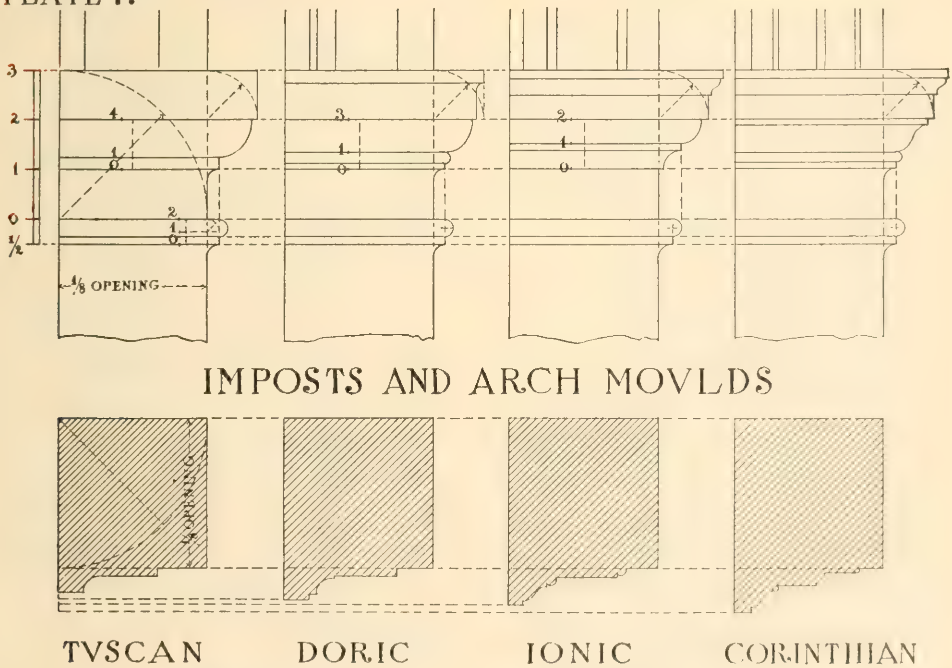

Plate VII.

Impost Mouldings.

Details are here given of impost mouldings, with their archivolts, suitable for the different Orders. The divisions of the imposts are all simple and similar in each example, the height of the corona and of its mouldings above, if any, being equal to the height of the mouldings below, which, again, are equal to the necking. The bead and fillet below the necking are one-sixth of the height of the impost, the bead being double the height of the fillet. The projection of the impost beyond the line of the pilaster is equal to the height of the corona and member over in the first two Orders, while the projection of the corona itself is equal to this height in the last two.

The pilaster is square on plan, and, therefore, the plan of the archivolt is represented by this square upon which the mouldings are placed. An examination of these mouldings will show that they resemble the architraves given for their respective Orders, and their forms admit of similar variations. It will be noticed that the innermost face is always in the plane of the face of the pilaster, while the projection of the moulding at the extrados increases from about one-quarter the width of the whole archivolt in the Tuscan to one-third in the Corinthian Order.

SUBJECT INDEX.

System of Classification for Filing Data, Drawings, Plates, Catalogues, Etc, in Architects' and Contractors' Offices.

INTRODUCTION.

The decimal system of classification was devised and elaborated by Mr. Melvil Dewey, formerly director of the New York State Library. This system was intended primarily for the use of librarians in the classification and arrangement of books and pamphets, but it was soon found that the system also furnished a simple and effective means of classifying, indexing and filing literary matter of all kinds. Engineers have found it useful for indexing technical data and information, catalogs, reports, card systems, drawings, etc., and it has been found equally useful by manufacturing and business concerns.

Much of the following subject matter has been obtained from the original publication of Mr. Dewey and extension bulletins published by the University of Illinois, but this data has all been rearranged and classified by the editor for the 1921 edition of the "Illinois Society of Architects HAND BOOK FOR ARCHITECTS AND BUILDERS." The purpose of the rearrangement being to bring the Index more nearly in accord with the trade divisions of modern practice.

EXPLANATION OF THE DECIMAL SYSTEM.

The essential characteristic of the Dewey System is its method of division and subdivision. The entire field of knowledge is divided into nine chief classes numbered by the digits from 1 to 9. Matter of too general a nature to be included in any of these classes is put into a tenth class and indicated by 0. The following are the primary classes of the Dewey System:

0 **GENERAL WORKS**
1 **PHILOSOPHY**
2 **RELIGION**
3 **SOCIOLOGY**
4 **PHILOLOGY**
5 **NATURAL SCIENCE**
6 **USEFUL ARTS**
7 **FINE ARTS**
8 **LITERATURE**
9 **HISTORY**

Each of these classes is again divided into nine divisions, with a tenth division for general matter, and each division is separated into nine sections. The sections are again sub-divided and the process may be carried as far as desired.

It is thought that this system will be especially valuable to architects for classifying drawings, catalogs, reports and technical data. Our space is too limited to publish the complete work, nor is it desirable. Should any one be sufficiently interested to go into the matter thoroughly, they should have Mr. Dewey's complete text on the subject. We are particularly concerned as practitioners of the profession of architecture with divisions 6 and 7, "Useful Arts" and "Fine Arts," comprising the following subject numbers:

600 USEFUL ARTS
610 **MEDICINE**
620 **ENGINEERING**
630 **AGRICULTURE**
640 **DOMESTIC ECONOMY**
650 **COMMUNICATION AND COMMERCE.**
660 **CHEMICAL TECHNOLOGY**
670 **MANUFACTURES**
680 **MECHANIC TRADES**
690 **BUILDING**

Omitting all sub-divisions of this topic, with the exception of **690 "Building,"** we publish the sub-divisions of same. As distinguished from **"Architectural Construction," "Building"** has to do more particularly with the processes of construction and matters pertaining to trades and materials involved in the construction of buildings should be more properly classified under "Building", while matters as to types and component architectural parts are more properly classified under **Architectural Construction.**

690 BUILDING — Materials and Trades.

690.0 **GENERAL.**
.01 **History.**
.011 History of Materials.
.012 History of the Art of Building.
.013 Biography of Architects.
.014 Biography of Builders.
.015 Biography of Craftsmen.
.02 **Organization of Construction.**
.03 **Finance of Building.**
.04 **Operation of Buildings.**
.05 **General Works on the Occupation and Art of Building.**
.051 Manuals.
.052 Handbooks.
.053 Receipts.
.054 Periodicals.
.055 Society Proceedings.
.056 Trade Unions, Guilds, Etc.
.057 Contractor's Associations.
.058 Material Dealer's Associations.
.059

690.1 **EDUCATION OF PERSONNEL CONCERNED IN BUILDING.**
.11 **Education of Designers.**
.12 **Education of Supervisors.**
.13 **Education of Managers.**
.14 **Education of Craftsmen.**

690.2 **BUILDING MATERIAL IN THE ABSTRACT.** (All special material should be classified under the appropriate trade.)

690.3 **PLANS FOR BUILDINGS.**
.30 **Incidents to the Preparation of Drawings.**
.301 Drafting Room Supplies.
.302 Drafting Methods.
.31 **Preliminary Studies.**
.32 **General Drawings.**
.33 **Scale Details.**
.34 **Full Size Details.**

690.4 **SPECIFICATIONS FOR BUILDINGS.**
.40 **Matter Pertaining to All Trades.**
.40-A General Conditions of the Contract.
.41 **Earth Working and Transportation Trades.** (See File 691.)
.41-A Preparation of Site.
.41-B Excavations.
.41-C Construction Plant.
.41-D Grading and Filling.
.41-E Preparation of Soil, Sodding and Seeding.
.41-F Planting.
.42 **Mortar Using Trades.** (See File 692.)
.42-A Masonry Materials.
.42-B Foundation Work.
.42-C Concrete Work.
.42-D Stone Work.
.42-E Brick Work.
.42-F Fireproofing, Furring and Partitions.
.42-G Architectural Terra Cotta.
.42-H Paving.
.42-I Plastic Floors.
.42-J Plastic Reinforcement, Lathing and Furring.

.42-K Plastering.
.42-L Plastic Insulation, Pipe Covering, Etc.
.42-M Models, Clay and Plaster.
.42-N Marble and Substitutes (Including Slate, Structural Glass Terrazzo-Slabs, Etc.)
.42-O Tile and Substitutes.

690.43 Wood-Working Trades and Hardware. (See File 693.)
.43-A Wood-Working Materials and Methods.
.43-B Carpentry.
.43-C Rough Carpentry Hardware.
.43-D Finish Hardware.
.43-E Special Door, Window and Screen Hardware.
.43-F Wood Furniture.

690.44 Heavy Metal Trades (employing metal heavier than No. 10 gauge). (See File 694.)
.44-A Metal Materials and Methods.
.44-B Structural Metal (over No. 10 gauge).
.44-C Miscellaneous Metal, Fire-escapes.
.44-D Ornamental Metal (over No. 10 gauge).
.44-E Vaults, Safes, Vault Doors, Etc.
.44-F Solid Metal Sash.
.44-G Heavy Metal Doors and Shutters.

690.45 Sheet Metal Trades (employing metal of No. 10 gauge or less. See File 695).
.45-A Sheet-Metal Materials and Methods.
.45-B Ordinary Sheet-Metal.
.45-C Sheet-Metal or Sheet-Metal Covered Fire-Resisting Doors and Windows.
.45-D Art Sheet-Metal Trim and Doors.
.45-E Metal Ceilings.
.45-F Sheet-Metal Furniture.
.45-G Miscellaneous Sheet-Metal, Store-Fronts, Etc.
.45-H Utensils.
.45-I Ventilating Ducts and Stacks, Furnace Work, Etc.

690.46 Brush, Broom and Swab-Using Trades (See File 696.)
.46-A Brush Trade Materials and Methods.
.46-B Water-proofing Membrane and Mastic or other Viscous Compositions mopped, broomed or swabbed in place.
.46-C Composition Roofing.
.46-D Plain Painting and Varnishing.
.46-E Decorations (Plain, Painted or Water Color).
.46-F Hangings, Fabrics, etc.
.46-G Upholstery.
.46-H Window Shades.
.46-I Plain Glass and Glazing.
.46-J Art Glass and Glazing.

690.47 Pipe Trades. (See File 697.)
.47-A Pipe Trades Materials and Methods.
.47-B Plumbing.
.47-C Gas-fitting.
.47-D Sprinkler Fitting.
.47-E Heating (including Steam and Hot Water Heating).
.47-F Steam Power Work.
.47-G Mechanical Ventilation.

690.48 Wire and Conduit Trades (See File 698).
.48-A Wire Trades Materials and Methods.
.48-B Electrical Conduit and Wiring.
.48-C Lighting Fixtures.
.48-D Electrical Power Work.

690.49 Machinery and Miscellaneous Trades (See File 699).
.49-A Machinery and Miscellaneous Materials and Methods.
.49-B Elevators.
.49-C Conveying Machines.
.49-D Mechanical Cleaners.
.49-E General Machinery.
49-F Mechanical Refrigeration.
49-G Insulation, Pipe Covering, Etc. (See File 690.42-L.)
.49-H Refrigerators, Coolers and Freezers.
.49-I Miscellaneous Equipment not Classified.

690.5 ESTIMATES FOR BUILDINGS.
690.6 CONTRACTS.
690.7 SUPERVISION OF CONSTRUCTION AND ACCOUNTS.
690.8 PROFESSIONAL SERVICES.
.80-A Remuneration, Fees, Commissions.
.80-B Duties, Relationships, Etc.
.80-C Responsibility, Etc.
.80-D License or Registration.
.81 Architect.
.82 Structural Engineer.
.83 Mechanical Engineer.
.84 Sanitary Engineer.
.85 Electrical Engineer.
.86 Illuminating Engineer.
.87 Clerk of the Works.
.88 Building Construction Manager.
.89 Specialists not otherwise Classified.

690.9 LAWS AND RULES CONTROLLING BUILDING.
.91 State or General Laws.
.92 Municipal Ordinances, Rules, Etc.
.93 Trade Rules.
.94 Findings, National Joint Board of Jurisdictional Awards.
.95 Lien Laws.
.96 Underwriters' Rules.
.97 Public Service Company's Rules.
.98 Liabilities of:
.981 Architects.
.982 Contractor.
.983 Workman.
.984 Owner.
.985 Bondsman.
.986 Liability Insurance Co.
.987 Adjoining Property Owner.
.988 Public.
.989 Any Other Responsibilities.

691 EARTH-WORKING, TRANSPORTATION AND TEAMING TRADES.

691.0 TOOLS, UTENSILS, APPARATUS, ETC.
.01 Shovels, Picks, Drills, Bars, Wheelbarrows, Etc.
.02 Plows, Scrapers, Trucks, Carts, Wagons, Teams, Tractors.
.03 Excavating, Trench and Mining Machinery.
.04 Hoists, Cranes, Pile Drivers, Conveyors, Etc.
.05 Dummy Railroad Equipment, Tracks, Cars, Etc.
.06 Soil Testing Apparatus.
.07 Shoring, Sheet Piling, Piling, Caissons, Etc.
.071 Wood.
.072 Metal.
.073 Concrete.
.08 Blasting Powder and Apparatus.
.09 Rock Crushers.

691.1 MATERIALS TO BE REMOVED.
.11 Common Earth, Clay, Sand, Gravel, Hard-pan, Conglomerate Rock, Etc.
.12 Trees, Shrubs, Etc.
.13 Rubbish, Etc.
.14 Buildings, Vaults, Pipes, Cisterns, Etc.

691.2 DISPOSAL OF MATERIALS.
.21 Stacking.
.22 Cartage.
.23 Dumps.

691.3 UTILIZATION OF MATERIALS.
.31 Sand and Gravel Stored for Mortar.
.32 Black Earth for Top Fill.
.33 Crushed Rock for Aggregate.
.34 Cleaning and Stacking Building Material for Use in New Building.
.35 Re-Planting and Protection of Trees and Shrubs.

691.4 FILLING MATERIAL.
.5 FERTILIZER.
.6 NURSERY STOCK.
.7 DRAINAGE MATERIAL.
.8 FROST PROTECTION.
.9

692 **MORTAR-USING TRADES** — (Inc. Masonry, Plastering, Tile and Marble Setting and the preparation for same).

692.0 **MASONRY APPARATUS.**
.01 **Mixing Boxes, Platforms, Etc.**
.02 **Tools, Hose, Heaters, Etc.**
.03 **Mixers for Mortar and Concrete.**
.04 **Scaffolding, Horses, Planks, Etc.**
.05 **Forms.**
.06 **Erection Apparatus, Hoists, Cranes, etc.**
.07 **Chutes.**

692.1 **MATERIALS FOR MASONRY.**
.11 **Liquids, Water, Anti-freezing, Etc.**
.12 **Aggregate** (a) Sand, (b) Stone Screenings, (c) Gravel, (d) Crushed Stone, (e) Crushed Slag, (f) Cinders, (g) Haydite.
.13 **Cementing Materials for Masonry.**
.131 Limes.
.132 Hydraulic Cements, (a) Natural, (b) Portland, (c) Miscellaneous.
.133 Gypsums, (a) Plaster of Paris, (b) Keene's Cement, (c) Miscellaneous.
.134 Magnesites.
.135 Asphaltic Cements.
.136 Composite Cements.
.137 Other Cements.
.14 **Solids for Masonry.**
.141 Stone.
.142 Brick, (a) Adobe, (b) Burned Clay, (c) Sand Lime.
.143 Structural Partition and Load-bearing Tile.
.144 Terra Cotta.
.145 Cement Blocks.
.146 Composite Blocks.
.147 Marble, Soapstone, Structural Slate and Glass.
.148 Tile, Paving and Wall.
.149 Terrazzo Blocks and Slabs.
.15 **Mason's Hardware.**
.151 Anchors, Ties, Wall Boxes, Plates, Inserts, Scoopers, Sleeves, Etc.
.152 Thimbles, Ash and Coal Chutes, Clean-out Doors, Dampers, Grate Bars, Chimney Cap, Vent Gratings, Etc.
.153 Vault Lights, Sidewalk Doors, Etc.
.154
.16 **Reinforcing for Masonry.**
.161 Bar Reinforcement.
.162 Frabric.
.163 Metal Lath.
.164 Wood-lath.
.165 Fiber, Hair, etc.

692.2 **STONE CONSTRUCTION.**
.21 **Preservatives Treatment.**
.22 **Bond, Anchorage, Ties, Lewises, Etc.**
.23 **Cutting and Dressing of Stone, Stereotomy, Drips, Weathering, Etc.**
.24 **Setting, Joints, Mortar, Bedding, Etc.**
.25 **Cleaning and Pointing.**

692.3 **BRICK CONSTRUCTION.**
.31 **Preservative Treatment.**
.32 **Common Brick Work.**
.33 **Fire Brick Work.**
.34 **Face Brick Work.**
.35 **Laying Joints, Mortar, Etc.**
.36 **Chases, Fire-Stops, Corbels, Etc.**
.37 **Bonds, Anchors, Etc.**
.38 **Cleaning and Pointing, Etc.**

692.4 **TERRA COTTA CONSTRUCTION.**
.41 **Preservative Construction.**
.42 **Bonding, Anchorage, Ties, Etc.**
.43 **Structural Tile Walls.**
.44 **Structural Tile Floors.**
.45 **Ornamental or Decorative Terra Cotta.**
.46 **Laying Joints, Mortar, Etc.**
.47 **Fitting Around Structural Parts.**
.48 **Centers, Supports, Protection.**
.49 **Cleaning, Pointing and Repairing.**
.5 **FIREPROOF CONSTRUCTION.**
.51 **Hollow Clay Tile, (a) Hard, (b) Porous.**
.52 **Gypsum Tile.**

692
.53 **Concrete.**
.54 **Tying, Fitting, Securing.**
.55 **Combination Construction.**
.56 **Centers, Forms, Etc.** (See 693.41 for Wood and 695 for Sheet-Metal.)
.59 **Patching, Repairing.**

692.6 **CONCRETE CONSTRUCTION.**
.61 **Massive, Caissons, Footings, Retaining Walls, Etc.**
.62 **High Duty Concrete.**
.63 **Hollow Concrete Building Blocks.**
.64 **Ornamental Concrete.**
.65 **Concrete Supported on the Ground, Paving of Walks, Floors, Drives, Etc.**
.66 **Waterproof Concrete.**
.67 **Reinforced Concrete.**
.671 Reinforcing Systems, Arranged Alphabetically.
.672 Forms and Centers. (See 693.41 for Wood; also 695 for Sheet-Metal.)
.673 Tests and Inspection.
.674 Data for Experiments.
.675 Formulae.
.676 Special Applications.

692.7 **DECORATIVE AND SANITARY WALL AND FLOOR SURFACING.**
.71 **Marble, Soapstone and Slate.**
.72 **Structural Glass.**
.73 **Terrazzo.**
.74 **Tile Mosaic,** (a) Ceramic, (b) Marble, (c) Glass.
.75 **Tile,** (a) Quarry, (b) Encaustic, (c) Marble, (e) Ornamental.

692.8 **WATER-PROOFING AND HARDENERS.**
.81 **Integral Waterproofing** (for brush applied mastic and painting, waterproofing, see File 696).
.82 **Hardeners** (a) Surface, (b) Admixed.

692.9 **PLASTER TRADES.**
.91 **Interior Plaster.**
.91(a) Common Lime Plaster.
.91(b) Gypsum Plaster.
.91(c) Magnesite.
.91(d) Portland Cement Plaster.
.91(e) Lathing.

693 **WOOD WORKING TRADES.**
.0 **APPARATUS, INCIDENTAL TOOLS, ETC.**
.01 **Mechanic's Tools.**
.02 **Wood-working Power Machinery,** (a) Saws, (b) Planers, (c) Stickers, (d) Sand-papering Machines, (e) Scraping Machines.
.03 **Kilns, Dryers.**
.04 **Scaffolding, Ladders, Horses and Benches.**

693.1 **MATERIALS.**
.11 **Lumber.**
.111 Timber, larger than 6"x6".
.112 Common Lumber.
.112 (a) Boards, Furring and Grounds.
.112 (b) Piece Stuff, Joists and Scantling.
.112 (c) Shingles.
.113 Finish Lumber.
.113 (a) Hardwood.
.113 (b) Soft Wood.
.113 (c) Flooring.
.114 Mill Stock.
.115 Veneers.
.12 **Glues.**
.13 **Rough Hardware.**
.131 (a) Nails, (b) Spikes, (c) Brads, (d) Tacks, Etc.
.132 (a) Bolts, (b) Rods, (c) Anchors, Ties, Etc.
.133 Rivets.
.134 (a) Washers, (b) Flitch Plates, (c) Splice Plates.
.135 Mill Construction Hardware, (a) Stirrups, (b) Hanger, (c) Column Caps, (d) Ties, (e) Box and Wall Anchors, (f) Bearing Plates, Etc.
.136 Double Hung Sash Hardware, (a) Pulleys, (b) Cords, (c) Chain, (d) Weights, (e) Spring Balances.
.137

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.138
.14 Finish Hardware.
.141 Hanging Hardware, (a) Butts, (b) Hinges, (c) Pivots, Etc.
.142 Controlling Hardware, (a) Bumpers, (b) Strikes, (c) Holders, (d) Hooks, (e) Stays, (f) Adjusters, Etc.
.143 Fastening Hardware, (a) Old Fashion Latches, (b) Spring Latches, (c) Catches, (d) Fasts, (e) Thumb Bolts, (f) Locks, Etc.
.144 Trimming Hardware, (a) Pulls, (b) Knobs, (c) Spindles, (d) Roses, (e) Escutcheons.
.145 Protection Hardware, (a) Kick Plates, (b) Push Plates, (c) Direction Plates or Signs, (d) Push Bars, Etc.
.146 Operating Hardware, (a) Closers and Checks, (b) Springs, (c) Weights and Pulleys, (d) Window Poles, Etc.
.147 Weathering Hardware, (a) Weather Strips, (b) Thresholds, (c) Special Drips, (d) Metal Astrigals, Etc.
.148 Automatic and Panic Hardware.
.149 Miscellaneous Hardware not otherwise classified, (a) Wardrobe Hardware, (b) Showcase Hardware, (c) Toilet-room Hardware.

693.2 ORDINARY CONSTRUCTION.
.21 Balloon Construction for Frame Buildings.
.22 Joist Construction for Masonry Buildings.

693.3 HEAVY TIMBER CONSTRUCTION.
.31 Heavy Post and Timber Construction for Frame Buildings.
.32 Mill Construction for Masonry Buildings.

693.4 AUXILIARY WOOD CONSTRUCTION FOR FIREPROOF BUILDINGS.
.41 Centers, Forms, Protective Covering, Scaffolding, Etc.
.42 Grounds, Attachment Strips, Etc.

693.5 JOINERY AND MILL WORK.
.51 Frames and Sash.
.511 Box Frames, Double Hung Sash.
.512 Casement Frames, Sash Opening In.
.513 Casement Frames, Sash Opening Out.
.514 Frames for Sash Hinged at Bottom, Swinging In at Top.
.515 Frames for Sash Hinged at Top, Swinging In at Bottom.
.516 Frames for Sash Hinged at Top, Swinging Out at Bottom.
.517 Frames for Horizontal Pivoted Sash.
.518 Frames for Vertical Pivoted Sash.
.52 Wood Interior Trim.
.53 Wood Floors.
.54 Blinds.
.55 Doors.
.551 Ordinary Panel and Sanitary Doors.
.552 Special Revolving Doors.
.553 Folding, Accordion Doors.
.554 Rolling Doors.
.56 Screens.
693.6 STAIR BUILDING.
693.7 ORNAMENTAL JOINERY, CABINET WORK.
WOOD FURNITURE.
693.8 WOOD CARVING.
.9 MISCELLANEOUS.

694 HEAVY METAL TRADES — (Employing Metal heavier than No. 10 gauge).

.0 TOOLS, UTENSILS, APPARATUS, ETC.
.01 Job Machinery.
.02 Job Tools. Hammers, Sledges, Punches, Tongs, Reamers, Riveters, Forges, Etc.
.03 Derricks, Cable, Hoisting Machinery.
.1 MATERIALS USED IN THE METAL TRADES.
.11 Iron Products.
.111 Cast-Iron.

694
.112 Wrought Iron.
.113 Steel.
.114 Alloys, (a) Copper Bearing Steel, (b) Nickel Steel, (c) Sheradized Steel.
.12 Copper.
.13 Brass.
.14 Bronze.
.15 Aluminum.
.16 Miscellaneous Structural Metals.

694.2 STRUCTURAL METAL CONSTRUCTION.
.21 Fabrication.
.211 Shop Drawings.
.22 Framing.
.221 Bases, Bearing Plates, Etc.
.222 Columns and Struts.
.223 Caps, Connections, Gussets, Etc.
.224 Girders, Beams, Etc.
.225 Suspenders, Tie-Rods, Chains, Etc.
.23 Preservatives.
.231 Paint. (See 696.)
.232 Galvanizing.
.233 Other Methods.

694.3 MISCELLANEOUS METAL.
.31 Fire Escapes.
.32
.33

694.4 HEAVY METAL DOORS, SHUTTERS, ETC.
.41 Underwriters' Doors.
.42 Sidewalk Doors.
.43 Shutters.

694.5 ORNAMENTAL METAL.
.51 Stairs.
.52 Enclosures, Guards, Grills, Fences, Gates, Etc.
.53 Elevator Enclosures and Cages.
.54 Fireplace Trimming.
.541 Andrions, Tongs, Pokers, Sparkscreens, etc.
.542 Grate Frames, Dampers, Grates, Etc.

694.6 SOLID METAL SASH.

694.7 VAULT DOORS, SAFES, VAULTS, ETC.
.71 Vault Doors.
.72 Safes.
.73 Vaults and Bank Equipment.

694.8

695 SHEET-METAL TRADES — (Employing Metal of No. 10 gauge or less).

695.0 TOOLS, UTENSILS AND APPARATUS (used by the Sheet-Metal Trades).
.01 Brakes, Shears, Mallets, Hammers, Etc.
.02 Welding Machines.
.03 Soldering Apparatus.
.04 Plating Apparatus.

695.1 SHEET-METAL MATERIALS.
.11 Sheet Iron.
.111 Tin or Tin Coated Sheet Iron.
.112 Galvanized Iron.
.12 Sheet Copper.
.121 Planished Copper.
.13 Zinc Sheet.
.14 Brass Sheet.
.15 Bronze Sheets.
.16 Other Sheet Metals.
.17 Solders, Fluxes, Etc.
.18 Hardware.
.181 Rivets and Bolts.
.182 Nails, Tacks and Screws.
.183 Incidental Hardware.
.19 Miscellaneous.

695.2 ORDINARY SHEET-METAL CONSTRUCTION.
.21 Roofs.
.211 Tin.
.212 Galvanized Iron.
.213 Copper.
.22 Cornices, Etc.
.23 Flashing, Gutters, Valleys, Down-Spouts and Conductor Heads.
.24 Sky-lights, Ventilator Heads, Etc.

695
.25 **Furnace Work, Casings, Ducts and Stacks, Etc.**
695.3 **FIRE RESISTING DOORS AND WINDOWS.**
.31 **Underwriters' Tin-Clad Doors.**
.32 **Underwriters Sheet-Metal Sash.**
.33 **Rolling Steel Shutters and Doors.**
695.4 **CEILINGS, STAMPED SHEET-METAL.**
695.5 **DRAWN SHEET-METAL.**
.51 **Store Front Bars.**
.52 **Showcase Bars, Etc.**
695.6 **TRIM AND DOORS OF SHEET METAL.**
695.7 **FURNITURE OF SHEET METAL.**
695.8 **UTENSILS OF SHEET METAL.**

696 BRUSH, BROOM AND SWAB-USING TRADES.
.0 **BRUSH TRADE, TOOLS AND APPARATUS.**
.01 **Kettles, Buckets, Ladles, Swabs and Other Roofers' and Waterproofers' Tools.**
.02 **Brushes, Cans, Knives, Etc.**
.03 **Ladders, Scaffolding, Hoists, Etc.**
.04 **Drop Cloths.**
.05 **Grinders.**
.06 **Spraying Machines.**
696.1 **BRUSH TRADE MATERIALS AND METHODS.**
.11 **Roofing and Waterproofing Materials.**
.111 Felt.
.112 Paper.
.113 Gravel, Slag, Crushed Stone, Paving Tile, Etc.
.12 **Painters' Materials.**
.121 Binders, (a) Oil, (b) Casein.
.122 Pigments, (a) White Lead, (b) Red Lead, (c) Zinc, (d) Graphite, (e) Whiting, (f) Lime, (g) Other Pigments.
.123 Colors, (a) Vegetable, (b) Mineral.
.124 Solvents, (a) Turpentine, (b) Benzine, (c) Alcohol, (d) Other Solvents.
.125 Wood Finishing Materials, (a) Stains, (b) Fillers, (c) Shellacs, (d) Varnishes, (e) Enamels, (f) Waxes, (g) Other Materials.
.13 **Water Paints.**
.131 Binder, (a) Casein, (b) Glue, (c) Other Binders.
.132 Pigments, (a) Lime, (b) China Clay, (c) Whiting.
.133 Colors.
.14 **Wall Papers.**
.15 **Hangings and Coverings.**
.151 Fabrics.
.152 Leather, (a) Genuine, (b) Imitation.
.16 **Hanging Hardware Poles, Etc.**
.17 **Upholstery,** (a) Tacks, (b) Feathers, (c) Hair, (d) Moss, (e) Ticking, (f) Cord, (g) Other Materials.
.18 **Glazing Material.**
.181 Glass, (a) Common Glass, (b) Plate Glass, (c) Ornamental Glass, (d) Wire-glass, (e) Prismatic Glass, (f) Colored Glass, (g) Glass Substitutes.
.182 Putties.
.183 Tacks.
.184 Leading Bars, (a) Lead, (b) Zinc, (c) Copper, (d) Ventilators.
.19 **Other Materials.**
696.2 **WATER-PROOFING WORK.**
.21 **Brushed on Construction.**
.22 **Membrane.**
696.3 **COMPOSITION ROOFING WORK.**
.31 **Tar and Gravel Roofing.**
.32 **Asphaltum Composition Roofing.**
.33 **Promenade Deck Roofing.**
696.4 **PAINTING WORK.**
.5 **WOOD FINISHING WORK.**
.6 **GENERAL DECORATIONS.**
.61 **Ordinary Water Color Tinting.**
.62 **Fresco Painting, Stenciling, Etc.**
.63 **Mural Decorations.**
.7 **UPHOLSTERY.**
.8 **HANGINGS.**

696
.81 **Ordinary Window Shades.**
696.82 **Lace Curtains.**
.83 **Draperies, Etc.**
.84
696.9 **GLAZING.**
.91 **Common Glazing.**
.92 **Art Glass Glazing.**

697 PIPE TRADES.
.0 **TOOLS, UTENSILS AND APPARATUS.**
.01 **Mechanic's Chest Tools, Furnaces, Etc.**
.02 **Power Pipe Cutter, Benders, Dies, Etc.**
.03 **Scaffolding Ladders, Etc.**
697.1 **MATERIALS.**
.11 **Metals,** (a) Wrought Iron, (b) Steel, (c) Lead, (d) Brass, (e) White Metal.
.12 **Pipe.**
.121 Wrought Iron, (a) Black, (b) Galvanized.
.122 Steel, (a) Black, (b) Galvanized.
.123 Cast Iron.
.124 Brass, Bronze and Copper.
.125 White Metal.
.126 Block Tin.
.127 Lead Lined Iron.
.128 Tin Lined Iron.
.129 Tile Pipe.
.13 **Pipe Fittings.**
.131 Screw Connections.
.132 Flange Connections.
.133 Union Connections.
.134 Caulked Connections.
.135 Valves, (a) Shut-off, (b) Gate, (c) Disk, (d) Other Valves.
.136 Pipe Hangers, Supports, Etc.
.137
.14 **Tanks.**
.141 Hot Water.
.142 Cold Water, (a) Wood, (b) Metal.
.143 Oil Tanks.
.144 Gas Tanks.
.15 **Boiler.**
.151 Steel Water Tube.
.152 Steel Flue Tube.
.153 Cast Iron Sectional.
.16 **Stoves.**
.161 Coal.
.162 Gas.
.163 Oil.
.17 **Furnaces, Grates and Stokers for Coal and Oil. (a) Ordinary, (b) Smokeless, (c) Dutch-oven, (d) Oil Burning, (e) Mechanical Feed.**
.18 **Brass Goods.**
.19 **Pottery.**
697.2 **SEWERAGE.** (See 692 for Masonry Sewers.)
.3 **PLUMBING TRADE.**
697.31 **Plumbing Fixtures.**
.311 Roughing-in, (a) Durham System, (b) Cast-Iron Caulked Joint System.
.312 Water Supply, (a) Pumps, (b) Tanks, (c) Hose and Fire Apparatus, (d) Fitters, (e) Sterilizers, (f) Ice Machinery, (g) Stills, Etc. (h) Domestic Heater.
.313 Garbage and Sewage Disposal.
.314 Fixtures for Plumbing, (a) Floor Drains, (b) Cesspools, (c) Sinks, (d) Slop Sinks, (e) Laundry Wash Trays, (f) Lavatories, (g) Bathtubs, (h) Showers, (i) Water Closets, (j) Urinals, (k) Bath and Toilet Room Trimmings, Paper-Holders, Towel Racks, Tumbler Holders, Soap Dishes, Etc.
697.4 **GAS FITTING.**
.41 **Meters.**
.42 **Fixtures.**
.43 **Gas-water Heaters.**
697.5 **MECHANICAL CLEANING.**
.6 **SPRINKLER FITTING.**
.60 Erecting Apparatus.
.61 Sprinkler-fitting Devices.
.7 **HEATING, STEAM AND HOT WATER AND VENTILATION.**

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.71 **One-Pipe Gravity.**
.72 **Two-Pipe Gravity.**
.73 **Vapor Two-Pipe.** (Systems arranged alphabetically.)
.74 **Vacuum.** (Systems arranged alphabetically.)
.75 **Radiation,** (a) Direct, (b) Direct-Indirect, (d) Indirect.
.76 **Boiler Trimmings.**
.77 **Automatic Regulators.**
.78 **Mechanical Ventilation.**
697.8 **STEAM-POWER WORK.**
.9 **OTHER PIPE TRADES.**

698 WIRE AND CONDUIT TRADES—Electrical Work of All Kinds.

.0 **TOOLS, UTENSILS AND APPARATUS.**
698.1 **MATERIALS FOR WIRE TRADES.**
.11 **Conduit.**
.111 Pipe.
.112 Flexible Greenfield, Etc.
.113 Moulding, (a) Wood, (b) Metal.
.114 Tile and Porcelain.
.115 Knob and Tube Substitute.
.12 **Insulation.**
.13 **Wire,** (a) Gauges, (b) Kinds.
.14 **Switchboards. Miscellaneous Devices.**
.141 Switchboards.
.142 Switches.
.143 Cut-out Cabinets, etc.
.144 Transformers.
.145 Receptacle Sockets.
.146 Door Openers.
.147 Batteries.
.15 **Lighting Fixtures, (a) Sockets, (b) General Fittings, (c) Pendents, (d) Brackets, (e) Indirect (f) Semi Indirect, (g) Special Reflectors.**
.16 **Telephones, Speaking Tubes, Bells, Etc.**
.161 Private Telephones.
.162 Signal System.
.163 Speaking Tube.
.164 Letter Boxes, Etc.
.17 **Motors and Generators.**
.18 **Lightning Rods.**
698.2 **GENERAL HOUSE WIRING FOR ILLUMINATING AND MINOR POWER WORK.**
698.3 **TELEPHONE WORK.**
698.4 **ELECTRIC POWER WORK.**
698.5 **CENTRAL STATION WORK.**
698.6 **OTHER ELECTRICAL WORK.**

699 MACHINERY TRADES AND MISCELLANEOUS BUILDING ITEMS—(Not Otherwise Classified).

699.0 **GENERAL MATTERS PERTAINING TO THE PREPARATION AND ERECTION OF MACHINERY.**
699.1 **MATERIALS.**
699.2 **ELEVATORS.**
699.3 **CONVEYING MACHINES.**
699.4 **MECHANICAL REFRIGERATION.**
699.5 **GENERAL MACHINERY.**
699.6 **INSULATION, PIPE COVERING, ETC.** (See 692 for Plastic Pipe Covering.)
699.7 **REFRIGERATORS, COOLERS AND FREEZERS.**
699.8
699.9 **MISCELLANEOUS TRADES NOT OTHERWISE CLASSIFIED.**
701 **PHILOSOPHY. THEORIES. UTILITY. AESTHETICS.**
702 **COMPENDS. OUTLINES.**
703 **DICTIONARIES. CYCLOPEDIAS.**
704 **ESSAYS. LECTURES. ADDRESSES.**
705 **PERIODICALS. MAGAZINES. REVIEWS.**

700 FINE ARTS.

706 **SOCIETIES. TRANSACTIONS. REPORTS, ETC.**

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707 **EDUCATION. STUDY AND TEACHING OF ART.**
708 **ART GALLERIES AND MUSEUMS.**
709 **HISTORY OF ART IN GENERAL.** Divided like 930-999.

710 LANDSCAPE GARDENING.

711 **PUBLIC PARKS.**
712 **PRIVATE GROUNDS. LAWNS.**
713 **WALKS. DRIVES. BRIDGES.**
714 **WATER. FOUNTAINS. LAKES.**
715 **TREES. HEDGES. SHRUBS.** See also 634.9, Forestry; 582, Botany.
716 **PLANTS. FLOWERS.** .1, Plants; .2, Flowers; .3, Conservatories; .4, Window gardens; .5, Ferneries.
717 **ARBORS. SEATS. OUTLOOKS.**
718 **MONUMENTS. MAUSOLEUMS.**
719 **CEMETERIES.** See also 393.1, Earth burial; 614.61, Public health.

720 ARCHITECTURE.

1\. Theories, Esthetics, Architectonics; .2, Compends, Manuals; .3, Dictionaries, Cyclopedias; .4, Essays, Lectures; .5, Periodicals; .6, Societies; .7, Education, Study, Training, Schools of Architecture; .8, Polygraphy, Collections; .9, General History of Architecture, divided geograically like 940-999.
721 **ARCHITECTURAL CONSTRUCTION.**
.1 **Foundations.** See Bridge Engineering, 624.1, Foundations.
.2 **Walls, Partitions, etc.**
.3 **Piers. Columns.**
.4 **Arched Constructions.**
.5 **Roofs.**
.6 **Floors and Flooring.**
.7 **Ceilings.**
.8 **Doors. Windows.**
.9 **Iron and Composite Structures.**
722 **ANCIENT ARCHITECTURE.** Include under this general classification all architecture from the beginning up to about A. D. 200 to 300.
.00 **Prehistoric Architecture.**
.1 **Egyptian or Nile Valley.** (Period 4000 B. C. to about 527 B. C.
.11 Old and Middle Empire. (4000-2000.)
.12 Shepherd Kings (2000-1600 B. C.).
.13 Theban New Empire (1600-1250 B. C.).
.14 The Decadence (1150-662 B. C.).
.15 Restoration (Saite Period) (663-525 B. C.).
.16 Persian Domination (525-332 B. C.).
.17 Ptolemaic Period (332-30 B. C.). End of Egyptian Independence (30 B. C.).
.2 **Western Asian Architecture.** Period 3800 ? to about 536 B. C.
.21 **Chaldaean** (3800 ? to 1500 ? B. C.).
.22 Assyrian (1500 ? to 1020 ? B. C.).
.23 Babylonian (1020 ? to 536 B. C.).
.24 Persian-Median (536 B. C. to 293 A. D.).
.241 First Empire founded by Cyrus (536-334).
.242 Sassanian Period (334 B. C. to A. D. 293).
.25 Jewish (1180 B. C.-70 A. D.
.26 Early Hittite.
.3 **East Asian Architecture.** Little is known of Chinese, Korean, Japanese, Indian and Philippine Architecture of the ancient period and dates can hardly be approximated.
.4 **Aegean Architecture.** North and east Mediterranean, including the islands of that sea.
.41 Cretan (Minoan).
.42 Mycean.
.43 Trojan.

.5 **Hellenic or Grecian.**
.51 Heroic or Homeric (1100-750 B. C.).
.52 Archaic (750-470 B. C.).
.53 Periclean (470-388 B. C.).
.54 Hellenistic (338-146 B. C.).
.6 **Ancient Italic Styles.**
.61 Etruscan (1000-40 B. C.).
.62 Roman (616 B. C.-313 A. D.).
.621 Etruscan influence (616-212 B. C.).
.622 Graeco-Italic (212-23 B. C.).
.623 Augustan (27 B. C.-14 A. D.).
.624 Imperial (14 A. D.-313 A. D.).

723 **MEDIAEVAL ARCHITECTURE.** The Architecture of the Middle Ages is generally understood to extend over a period from 300 A. D. to about 1450 A. D.
.1 **Byzantine or Early-Christian.** Developed under the Roman Emperor Constantine, at Constantinople, and to a more or less extent in all countries bordering the Mediterranean.
.11 Basilican Type, derived from the Roman business exchange, adopted more generally as the early Christian church in Western and Northern Europe.
.12 Baptistry Type, derived from the Roman Bath, adopted more generally in Eastern Europe and Western Asia and North Africa for early Christian Church, motif for Mohammedan Mosque.
.121, Early Christian subdivided according to political divisions of the time.
.122, Mohammedan-Moorish effected with Persian influence later becomes a distinct style.

.2 **PERSIAN MEDIAEVAL** (293 A. D. to 1499). Developed under more or less Roman influence up to Mohammedan conquest; after that gradually developed the Mohammedan Style.
.21 Sassanian (293 A. D. to 652 A. D.).
.22 Mohammedan (652 to 1499 A. D.).
.3 **Indian.**
.31 Buddhist.
.32 Jaina.
.33 Brahman.
.34 Indo-Moslem.
.4 **Chinese, Korean and Japanese.**
.5 Mohammedan Style.
.51 Moorish, Turkish, Persian, Indian.
.6 **Romanesque.** The Architecture of Europe between the Roman-Byzantine period and the Gothic (Period about 900 A. D. to about 1100 A. D.). .61, Austrian; .62, British Isles; .63, French and Belgian; .64, German; .65, Holland and Switzerland; .66, Italian; .67, Scandinavian; .68, Spanish; .69, Unclassified.
.7 **Gothic.** The Architecture of Europe between the Romanesque period and the Neo-Classic (Period about 1150 A. D. to 1450 A. D., traces in Spain and Italy as far back as 475 A. D.). The name means Architecture of the Goths.
.71 Austrian; .72, British Isles; .63, French and Belgian; .64, German; .65, Holland and Switzerland; 66, Italian; 67, Scandinavian; 68, Spanish and Portuguese; .69, Unclassified.

724. **MODERN.**
.1 **Renaissance;**
.2 **Classical Revival. Grecian.**
.3 **Gothic Revival.**
.4 **Tudor Gothic Revival.**
.5 **Queen Anne Revival.**

724.6 **Neo Grec.**
.7 **Half-Timber Swiss.**
.8 **Romanesque Revival.**
.9 **Other Recent Styles.**

725 **PUBLIC BUILDINGS.**
.1 **Administrative. Governmental.**
.11 Capitols. Houses of Parliament.
.12 Ministries of War, State, etc.
.13 City and Town Halls. Bureaus. Public Offices. City Plans.
.14 Custom Houses. Bonded Warehouses. Excise Offices.
.15 Court Houses. Record Offices.
.16 Post Offices, General and Special.
.17 Official Residences. Palaces of Rulers.
.18 Barracks. Armories. Police Stations.
.19 Engine Houses. Fire Alarm Stations
.2 **Business and Commercial.**
.21 Stores, Wholesale and Retail.
.22 Mixed Store, Office, and Apartment Buildings.
.23 Office Buildings. Telegraph. Insurance. Loft.
.24 Banks. Safe Deposit. Savings.
.25 Exchanges. Boards of Trade.
.26 Markets.
.27 Cattle Markets. Stock Yards.
.28 Abattoirs.
.29 Other Business Buildings.
.3 **Transportation and Storage.**
.31 Railway Passenger Stations.
.32 Railway Freight Houses.
.33 Railway Shops, Round Houses, Car Houses, Tanks, Stores.
.34 Dock Buildings. Wharf Boats and Houses.
.35 1, Warehouses; 2, Cold Storage; 3, Safe Deposit Storage.
.36 Elevators, Grain.
.37
.38
.39 Other.
.4 **Manufactories.**
.41 Textile Factories or Mills. Wool, Cotton, Silk.
.42 Breweries. Malteries. Distilleries.
.43 Foundries. Machine Shops. Iron and Steel Works.
.44 Wood-working Mills. Furniture Factories.
.45 Carriage and Car Factories.
.46 Paper Mills.
.47 Mills for Flour, Meal, Feed, etc.
.48 Pottery, Glass, Terra Cotta, Brick Works.
.49 Other Manufactories.
725.5 **Hospitals and Asylums.** See also 725.6. Reformatories.
.51 Sick and Wounded. Eye and Ear. Incurables. Lying-in.
.52 Insane.
.53 Idiotic. Feeble-minded.
.54 Blind. Deaf and Dumb.
.55 Paupers. Almshouses.
.56 Aged.
.57 Children. Orphans.
.58 Foundling.
.59 Soldiers' Homes.
725.6 **Prisons and Reformatories.**
.61 State Prisons. Penitentiaries.
.62 Jails. Cell Houses.
.63 Reformatories for Adults. Houses of Correction.
.64 Reform Schools.
.65 Inebriate Asylums.
725.7 **Refreshment. Baths. Parks.**
.71 Cafés. Restaurants.
.72 Saloons.
.73 Baths: Warm, Medicated, Turkish, Russian.
.74 Swimming Baths.
.75 Buildings for Watering Places, Spas, etc.
.76 Buildings for Parks and Streets, Public Comfort Stations.
725.8 **Recreation.**
.81 Music Halls Auditoriums.
.82 Theatres. Opera Houses.
.83 Halls for Lectures, Readings, etc.
.84 Bowling Alleys. Billiard Saloons.

725
.85 Gymnasiums. Turn Halls.
.86 Skating Rinks. Bicycle Rinks.
.87 Boat Houses. Bath Houses.
.88 Riding Halls and Schools.
.89 Shooting Galleries.
725.9 **Other Public Buildings.**
.91 Exhibition Halls.
.92 Temporary Halls. Tabernacles. Wigwams.
.93 Workingmen's Clubs and Institutes.
.94 Town Squares.
.95 **Summer Recuperating Camps.**
726 **ECCLESIASTICAL AND RELIGIOUS.**
.1 **Temples.**
.2 **Mosques.**
.3 **Synagogues.**
.4 **Chapels. Sunday-school Buildings.**
.5 **Churches.**
.51 Frame.
.52 Brick or Stone.
.521 Small. Audt., seating less than 600.
.522 Large Audt., seating more than 600.
.6 **Cathedrals.**
.7 **Monasteries. Convents. Abbeys.**
.8 **Mortuary. Cemetery Chapels. Receiving Vaults. Tombs.**
.9 **Other. Y. M. C. A., etc.**
727 **EDUCATIONAL AND SCIENTIFIC.**
.1 **Schools.**
.11 Ward and Grammar.
.12 High Schools.
Study and Recitation Rooms. Not including dormitory or boarding.
.2 **Academies. Seminaries. Boarding Schools.**
.3 **Colleges. Universities.**
.4 **Professional and Technical Schools. Law, Theology, etc.**
.5 **Laboratories: Physical, Chemical.** See 542.1, **Biological, etc. Zoological and Botanic Gardens.** See also 590.7 and 580.7.
.6 **.1, Museums. .2, Herbariums.** See 580.7.
.7 **.1, Art Galleries. .2, Studios.**
.8 **Libraries.** See 022, Library Buildings.
.9 **Other. Learned Societies, etc.**
728 **RESIDENCES.**
.1 **Tenement Houses.**
.11 City Homes of Poor.
.12 Country Homes of Poor.
.13 Cités Ouvrieres.
728.2 **Collective Dwellings.**
.21 Flats; one family to the floor.
.211 Small Flats less than 8 rooms.
.212 Large Flats, 8 rooms or more.
.22 Apartment Houses; more than one family to floor.
.221 Five Suites or Less.
.222 Six Suites or More.
.2221 Elevator Service.
.2222 No Elevator Service.
728.3 **City Houses. Mansions. Palaces.**
.31 Between party-walls. Stone.
.32 Between party-walls. Brick.
.33 Between party-walls. Partly wood.
.34 Semi-detached, including end houses in city blocks. Stone.
.35 Semi-detached, including end houses in city blocks. Brick.
.36 Semi-detached, including end houses in city blocks. Partly wood.
.37 Detached. Stone.
.38 Detached. Brick.
.39 Detached. Partly wood.
728.4 **Club Houses. Buildings for Secret Societies.**
.5 **Hotels.**
.51 City Hotels.
.52 Summer Resorts.
.53 Country Inns.
728.6 **Village and Country Homes.**
.61 Village Dwellings. On small lots.
.62 Stone.
.63 Brick.
.64 Concrete or stucco.
.65 Part masonry, part wood.

728
.66 All wood, 1, less than 7 rooms; 2, 7-12 rm; 3, 13 rm or over.
.67 Farm Houses.
.68 Laborers' Cottages. 1, Frame; 2, Masonry.
728.7 **Seaside and Mountain Cottages. Chalets.**
728.8 **Country Seats.**
.81 Castles.
.82 Chateux.
.83 Manor Houses.
.84 Villas
.85 Log Houses.
.86 Bungalows.
728.9 **Out-Buildings.**
.91 Porters' Lodges.
.92 Servants' Quarters.
.93 Kitchens and Laundries.
.94 .1, Stables. .2, Carriage Houses. .3, Garages.
.95 Barns, Granaries.
.96 Dairies.
.97 Ice Houses.
.98 Conservatories. Green Houses. Graperies.
.99 Other.
729 **ARCHITECTURAL DESIGN AND DECORATION.**
.1 **The Elevation.**
.11 Composition; .12, Distribution; .13, Proportion; .14, Light and Shade; .15, Perspective effect; .15, .16, .17, .18, .19.
For projection of shadows and graphics of light and shadow see 515.63 and 515.7.
.2 **The Plan.**
.21 Elements required; .22, Distribution; .23, Proportion; .24, .25, .26, .27, .28, .29.
.3 **Elementary Forms.** For construction of these forms see 721.
.31 Walls. Mouldings. Cornices. .32, Piers, Columns, Pilasters, Pedestals and the Orders. Colonnades. .33, Arches and Arcades. .34, Vaults and Domes. .35, Roof. Spires. Dormers. .36, Towers. .37, Gables and Pediments. .38, Doors and Windows. Bays. Oriels. .39, Stairs and Balustrades. See also 515.83, Stereotomy; 604.8, Building.
.4 **Painted Decoration.**
729.5 **Decoration in Relief.**
.6 **Incrustation and Veneering.**
.7 **Mosaic and Marble.**
.71 Mosaic Ceilings; .72, Mosaic Walls; .73, Mosaic Floors; .74, Other Mosaic designs; .75, .76, .77, .78, .79.
.8 **Stained Glass Design.** For technical processes see 666.1; for history see 748.
.9 **Architectural Accessories and Fixed Furniture.**
.91 Altars, Pulpits, Tribunes, Dais Thrones (Ecclesiastical).
729.92 Seating for Public Buildings.
.921 Benches; 2, Settees; 3, Portable Chairs and Opera Chairs.
.93 Domestic Chairs, Tables, Couches. Stools, Beds, etc.
.94 Buffets.
.95 Mantels. Overmantels. Andirons.
.96 Steel Furniture.
.97 Window Shades.
.98 .1, Organs. .2, Pianos.
.99 Lighting Fixtures.
730 SCULPTURE.
731 **MATERIALS AND METHODS.**
732 **ANCIENT.**
733 **GREEK AND ROMAN.**
734 **MEDIEVAL.**
735 **MODERN.**
736 **CARVING. SEALS. DIES. GEMS. CAMEOS.**
737 **NUMISMATICS. COINS. MEDALS.**
738 **POTTERY. PORCELAIN.**
739 **BRONZES. BRASSES. BRIC-A-BRAC.**

INDEX TO MISCELLANEOUS AND USEFUL INFORMATION

According to Decimal System with Page Numbers and Relative Index.

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W.

CLASSIFIED LIST OF ADVERTISERS

Advertisers are classified with a view to furnish Architects and others a ready reference list of houses engaged in the Building Business. Besides the Index to Advertisements on page 572, the number of the pages on which the Advertisements appear follows directly after each name Classified in this list. It is requested that those using it will kindly mention this book in their correspondence.

COLD STORAGE INSULATION.

Ill. Fire Proof Cov. Co., 216 W. Kinzie St. 424
Matot, D. A., 1538 Montana St. 120-276
Union Insul. & Constr. Co., 20 W. Jackson 46

COLUMN CLAMPS.

Dean, Olney, J. & Co., 179 W. Wash. 402
Universal Form Clamp Co., 14 N. May St. 386

COLUMNS—WOOD.

Hartmann-Sanders Co., 2155 Elston Av. 316

COMPOSITION FOR EXTERIOR AND INTERIOR—ORNAMENTAL.

Architectural Dec. Co., 1600 S. Jefferson 544
Dux, Joseph, 2112 W. Van Buren St. 544

CONCRETE—ENAMELS.

Advance Waterproof Cement Co., 15 E. Van Buren St. 316

CONCRETE FORM CLAMPS.

Universal Form Clamp Co., 14 N. May St. 386

CONCRETE HARDENER.

Advance Waterproof Cement Co., 15 E. Van Buren St. 316
Am. Builders Products Co., 64 E. Van Buren St. 422
Scofield, Evans & Co., 508 S. Dearborn 422
Stevens Partition & Floor Deadener Co., 14 E. Jackson Blvd. 362

CONCRETE PILES.

Raymond Con. Pile Co., 111 W. Monroe 12

CONCRETE REINFORCING BARS—STEEL.

(See Reinforcing Bars—Concrete)

CONCRETE REINFORCING STEEL FABRIC.

(See Steel Fabric for Reinforcing Concrete)

CONCRETE SPACERS AND SUPPORTS.

Universal Form Clamp Co., 14 N. May St. 386

CONDUITS—UNDERGROUND—STEAM PIPES.

Stannard Power Equipment Co., 53 W. Jackson 448

CONTRACTORS' BONDS.

Builders & Mfgrs. Mutual Casualty Co., 133 W. Washington St. 42
Sherman & Ellis, Inc., 11 S. La Salle St. 268

CONVEYORS—BELT & GRAVITY.

Chgo. Pulley & Shaft. Co., 32 S. Clinton St. 58
Olson, Samuel & Co., 2418 Bloomingdale 14
Weller Mfg. Co., 1856 N. Kostner Av. 80

COOLING SYSTEMS FOR BUILDINGS.

Genl. Ventilating & Mfg Co. 6008 S. State 458
Gustafson, K. A., 2114 N. Springfield 484
Herlihy, J. J., 751 W. Van Buren St. 476
Haines Co., 1933 W. Lake St. 460
Mehring & Hanson Co., 118 N. Franklin 462
Mellish-Hayward Co., 213 W. Austin Av. 484
Monarch Vent. Co., 1338 Sedgwick St. 456
Narowetz Heat. & Vent. Co., 1711 Park 460
Webster, Warren & Co., 53 W. Jackson 482
Wittenmeier Mchy. Co., 850 N. Spaulding 126

CORK INSULATION.

Ill. Fire Proof Cov. Co., 216 W. Kinzie St. 424
Union Insul. & Const. Co., 20 W. Jackson 46

CORNICES—COPPER, GALVANIZED.

Gustafson, K. A., 2114 N. Springfield 484

CORRUGATED IRON.

Scully Steel & Iron Co., 2364 S. Ashland 376

CREOSOTED WOOD BLOCKS.

Indiana Zinc Creosoting Co., 111 W. Wash. 70

CREOSOTED LUMBER—TIES—TIMBER AND PILING.

Indiana Zinc Creosoting Co., 111 W. Wash. 70

CRUSHED STONE.

Brownell Improve. Co., 133 W. Wash. 310

CURB GUARDS—CONCRETE.

Calumet Steel Co., 208 S. La Salle St. 396

CUT STONE.

Cent. Oolitic Stone Co., 2126 S. Kedzie 76
Consolidated Stone Co., 140 S. Dearborn 410
Furst-Kerber Cut Stone Co., 2301 S. La Salle St. 406
Indiana Quarries Co., 112 W. Adams St. 404
McMillan, Wm. & Sons, 10 S. La Salle St. 408

DAMP RESISTING COMPOUNDS.

Advance Waterproof Cement Co., 15 E. Van Buren St. 316
Am. Builders Products Co., 64 E. Van Buren St. 422
Am. Tar Products Co., 208 S. La Salle 272
Barrett Co., 10 S. La Salle St. 26
Crescent Sales & Mfg. Co., 110 S. Dear. 24
Johns-Manville Co., 18th & Mich. 8
Ohmlac Paint & Rfg. Co., 140 S. Dearborn 530
Scofield, Evans & Co., 508 S. Dearborn 422
Semet Solvay Co., 332 S. Michigan Av. 420

DAMPPROOFING—CONCRETE.

Scofield, Evans & Co., 508 S. Dearborn 422
Semet Solvay Co., 332 S. Michigan Av. 420

DEADENING MATERIAL.

Am. Tar Products Co., 208 S. La Salle 272
Barrett Co., 10 S. La Salle St. 26
Bird & Son, 1472 W. 76th St. 22
Cabot, Samuel, 24 W. Kinzie St. 308
Ford Roofing Products Co., 111 W. Wash. 94
Johns-Manville Co., 18th & Mich. 8
Servicised Products Co., 38 S. Dearborn St. 96
Stevens Partition & Floor Deadener Co., 14 E. Jackson 362
Union Insul. & Constr. Co., 20 W. Jackson 46

DECORATORS—INTERIOR.

Brennen, J. M. & Co., 651 W. 43rd St 538
Ebert, Theo. Co., 828 Diversey Pkwy. 536
Gleich, T. C. Co., 2850 Broadway 532
Milligan, Geo. D. Co., 616 S. Michigan Av. 540
Mitchell & Halbach Co., 1715 S. Michigan 540
Nelson Bros., 2568 N. Clark St. 534
Nelson, W P. Co., 614 S. Michigan Av. 532
Noelle, J. B. Co., 702 N. Wells St. 542
Olson, Hermann Dec. Co., 911 Chgo. Av. Evanston, Ill. 542
Plamondon & Gabriel Co., 308 N. Mich. 536
Rising Dec. Co., 527 S. Peoria St. 538
Spierling & Linden, 1216 Michigan Av. 542
Sullivan, J. P., 4515 Indiana Av. 534

DERRICKS.

Sasgen Derrick Co., 3103 W. Grand Av. 124

DOOR STOPS.

Grand Specialties Co., 3103 Grand Av. 304

DOORS.

Chgo. Sash, Door & Blind Mfg. Co., 1249 W. North Av. 278
Curtis Door & Sash Co., 1414 S. Western 160
Dahlstrom Metallic DoorCo., 19 S. La Salle 390
Morgan Sash & Door Co., 2287 Blue Island Av. Inside Front Cover
Morris, Wm. & Sons, Co., 1000 W. 50th St. 278
Nollau & Wolff Mfg. Co., 1705 Fullerton 316

DOORS—CROSS HORIZONTAL FOLDING.

Hill, O. H. Co., 2253 St Paul Av. 374
Kinnear Mfg. Co., 208 S. LaSalle St. 402
Variety Fire Door Co., 2958 Carroll Av. 402

DOORS—FLUSH VENEERED.

Chgo. Sash, Door & Blind Mfg. Co., 1249 W. North Av. 278
Curtis Door & Sash Co., 1414 S. Western 160
Morgan Sash & Door Co., 2287 Blue Island Av. Inside Front Cover
Morris, Wm. & Sons Co., 1000 W. 50th St. 278

DOORS—HOLLOW METAL.

Dahlstrom Metallic Door Co., 19 S. La Salle St. 390
Hill, O. H. Co., 2253 St. Paul Av. 374
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Variety Fire Door Co., 2958 Carroll Av. 402

DOORS—SLIDING SWING.

Dodge, H. B. & Co., 332 S. Michigan Av. 266
Smith, F. P. W. & I. Wks., 2346 Clybourn 398

DRAIN BASE.

Josam Mfg. Co., 15 E. Van Buren St. 512
Stannard Power Equipment Co., 53 W. Jackson 448
Wade Iron Sanitary Mfg. Co., 551 Fulton 514

GARBAGE CREMATORIES.

Kerner Incinerator Co., 28 E. Jackson 136
Kewanee Boiler Co., 328 W. Washington 434
Maher Engineering Co., 30 N. Michigan 72
Weil-McLain Co., 641 W. Lake St. 440

GAS APPLIANCES.

Peoples Gas Light & Coke Co., 122 S. Michigan 352-354

GAS AND ELECTRIC FIXTURES.

Everson, C. G. & Co., 70 W. Lake St. 350
Peoples Gas Light & Coke Co., 122 S. Michigan 352-354

GAS FITTING.

Am. Heat. & Plumb. Corp., 189 N. Clark 462
Corboy, M. J. Co., 178 W. Randolph St. 516
Cornell, W. G. Co., 232 E. Ohio St., 484
Daly, J. J., 408 N. Wells St. 516
Dwyer & Co., 31 W. Illinois St. 476
Griffith, Wm. H., 3656 Broadway 518
Hulbert & Dorsey, 208 N. Wells St. 516
Murphy Plumbing Co., 23 E. Congress 516
Nacey, P. Co., 927 S. State St. 98
Nilson Bros., 3222 N Halsted St. 476
Nilson, G. Albin & Co., 155 N. Clark St. 518
Noble & Thumm, 2313 Lincoln Av. 518
Watson, W. W., 708 Carpenter St. 518

GAS—ILLUMINATING.

Peoples Gas Light & Coke Co., 122 S. Michigan 352-354

GAS LOGS AND GAS GRATES.

Colonial Fireplace Co., 4626 W. Roosevelt 82
Interior Tiling Co., 21 E. Van Buren St. 360
Pearlman, Victor A. & Co., 533 S. Wabash Av. 318
Peoples Gas Light & Coke Co., 122 S. Michigan 352-354

GAS RANGES AND STOVES.

Cribben & Sexton Co., 600 N. Sacramento 356
Janows & Kramer Co., 640 W. Randolph 128
Peoples Gas Light & Coke Co., 122 S. Michigan 352-354
Pick, Albert & Co., 212 W. Randolph St. 6

GENERAL CONTRACTORS.

Anderson, A. & E. Co., 19 S. La Salle 282
Anderson, Edward A. Co., 8 E. Huron St. 294
Archibald, E. L. Co., 111 W. Wash. 282
Ardmore Constr. Co., 186 N. La Salle St. 300
Barnard, H. B., 140 S. Dearborn St 142
Blome-Sinek Co., 139 N. Clark St. 148
Broline-Nolan Co., 5 N. La Salle St. 292
Brundage, Avery, 110 S. Dearborn St. 140
B. W. Constr. Co., 720 Cass St. 152
Cadenhead Co., 8 E. Huron St. 294
Cement Gun Cnstr. Co., 537 S. Dearborn 566
Chaney, J. H. & Son Co., 189 W. Madison 298
Dahl-Stedman Co., 11 S. La Salle St. 150
Ericsson, Henry Co., 139 N. Clark St. 144
Gage, Thos. G. Co., 64 W. Randolph St. 292
Griffiths, John & Son Co., 112 W. Adams 132
Hanson Bros. Co., 127 N. Dearborn St. 290
Johnson, E. V. Co., 20 W. Jackson Bl. 156
Krahl Constr. Co., 350 N. Clark St. 158
Lanquist & Illsley Co., 1100 N. Clark St. 138
Lynch, Austin J. Co., 111 W. Monroe St. 300
McKeown Bros. Co., 112 W. Adams St. 280
McLennan Constr. Co., 400 N Michigan 286
Moses, C. A. Constr. Co., 133 W. Wash. 144
Nielson, S. N. & Co., 3059 Augusta St. 290
Olson Peter Co., 19 S. La Salle St. 288
Rasmussen, C., 154 W. Randolph St. 296
Rosenthal-Cornell, O. W. Co., 80 E. Jack. 288
Salomon-Watertown Co., 230 E. Ohio St. 296
Scharmer Constr. Co., 139 N. Clark St. 284
Shedden, James & Co., 106 N. La Salle St. 286
Snyder, J W. Co., 122 S. Michigan Av. 134
Sollitt, Ralph & Sons Constr. Co., 5 N. La Salle St. 284
Strandberg, E. P. Co., 232 E. Ohio St. 280
Thielberg, A. C., 154 W. Randolph St. 298
Thompson-Starrett Co., 175 W. Jackson 136
Thomson, Geo. & Son Co., 30 N. La Salle 154
Wilson, R. F. & Co., 1851 Elston Av. 130

GLASS—ART, ORNAMENTAL AND STAINED.

Spierling & Linden, 1216 Michigan Av. 542

GLASS AND GLAZING.

Hooker, H. M. Glass & Paint Co., 651 W. Washington 552
Morlite Co., 366 W. Ohio St. 550
Tyler & Hippach, 366 W. Ohio St. 550

GLASS—PRISMATIC.

Am. 3 Way-Luxfer Prism Co., Cicero, Ill 100-552
Hooker, H. M. Glass & Paint Co., 651 W. Washington 552
Morlite Co., The, 366 W. Ohio St. 550
Tyler & Hippach, 366 W. Ohio St., 550

GLASS—WIRE.

Mississippi Wire Glass Co., 7 W. Madison St. 546

GRAIN ELEVATOR MACHINERY.

Kaestner & Hecht Co., 500 S. Throop St. Inside Back Cover
Olson, Samuel & Co., 2418 Bloomingdale 14
Weller Mfg. Co., 1856 N. Kostner Av. 80

GRATES AND FIREPLACES.

Colonial Fireplace Co., 4626 W. Roosevelt Road 82
Interior Tiling Co., 21 E. Van Buren St. 360

GRAVEL.

Brownell Improv. Co., 133 W. Wash. 310
Consumers Co., 111 W. Washington 56
Dee, Wm. E. Co., 30 N. La Salle St. 310
Janesville Sand & Gravel Co., 111 W. Monroe St. 310
Rosing, Astrid S., 111 W. Monroe St. 28

GRILLE WORK.

Architectural Dec. Co., 1600 S. Jefferson 544
Dux, Joseph, 2112 W. Van Buren St. 544

GRILLE WORK—METAL.

(See Iron Work—Ornamental)

GYPSUM PRODUCTS.

Am. Cement Plaster Co., 111 W. Wash. 20
U. S. Gypsum Co., 205 W. Monroe St. 38

HANGERS AND SHAFTING.

Chgo. Pulley & Shafting Co., 32 S. Clinton Street 58
Scully Steel & Iron Co., 2364 S. Ashland 376

HARDWARE—BUILDERS.

Casement Hardware Co., 232 E. Ohio St. 274
Lawson Mfg. Co., 228 W. Superior St. 84-86
Midwest Hardware Co., 56 W. Randolph 60
Monarch Metal Products Co., 5020 Penrose St., St. Louis Mo. 62
Sager Metal Weather Strip Co., 162 W. Austin 78

HARDWOOD FLOORING.

(See Flooring—Hardwood)

HEATING APPARATUS.

Clow Jas. B. & Sons, 544 S. Franklin 490
Gordon, Robt. Inc., 1355 W. Washington Blvd. 472
Ill. Malleable Iron Co., 1801 Diversey 452
Kellogg Mackay Co., 419 W. 18th St. 432
Kewanee Boiler Co., 328 W. Washington 434
Maher Engineering Co., 30 N. Michigan 72
Monarch Vent. Co., 1338 Sedgwick St. 456
Nacey, P. Co., 927 S. State St. 98
Robinson Furnace Co., 205 W. Lake 482
Utica Heater Co., 218 W. Kinzie St. 438
Weil-McLain Co., 641 W. Lake St., 440
Wear & Craig Co., 6316 Wentworth Av. 452

HEATING CONTRACTORS—HOT WATER —STEAM—VACUUM—VAPOR.

Am. Heat & Plumbing Co., 189 N. Clark 462
Arcade Steam Heat. Co., 126 W. Kinzie 474
Claffey, E. J. Co., 10 W. Illinois St. 468
Cornell, W. G. Co., 232 E. Ohio St. 484
Crane, M. H. Est., 28 N. Desplaines St. 474
Dewar & Carrington, 153 N. Desplaines Street 472
Dwyer & Co., 31 W. Illinois St. 476
Gallaher & Speck, 215 W. Congress St. 480
Glennon-Bielke Co., 546 W. Lake St. 468
Gordon, Robt. Inc., 1355 W. Washington Boulevard 472

IRON DOORS AND SHUTTERS.

Butler St. Fdry & Iron Co., 3424 Normal 398
Dahlstrom Metallic Door Co. 19 S. La Salle 390
Halsted, Joseph, Co., 1233 W. Randolph 380
Hanke Iron & Wire Wks., 840 N. Albany 400
Hill, O. H. Co., 2253 St. Paul Av. 374
Holmes, Pyott & Co., 159 N. Jefferson 394
Ill. Malleable Iron Co., 1801 Diversey 452
Kinnear Mfg. Co., 208 S. La Salle St. 402
Simpson-Frisch Co., 1401 Wabansia Av. 388
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Variety Fire Door Co., 2958 Carroll Av. 402
Vierling Steel Wks., 313 W. 23rd St. 400
Western Iron Constr. Co., 4906 N. Clark 400
Weymer, E. M. Co., 1800 N. Francisco Av. 388

IRON STAIRS—RAILINGS AND FENCES.

Bolter's, A., Sons, 2301 Ward St. 394
Butler St. Fdry. & Iron Co., 3424 Normal 398
Castle, A. M., & Co., 1152 Blackhawk St. 378
Cyclone Fence Co., Waukegan, Ill. 48
Duffin Iron Co., 4837 S. Kedzie Av. 376
Federal Iron Wks., 30 N. La Salle St. 394
Guaranty Iron & Steel Co., 3847 W. Lake 398
Halsted, Joseph Co., 1233 W. Randolph 380
Hanke Iron & Wire Wks., 840 N. Albany 400
Holmes, Pyott, & Co., 159 N. Jefferson 394
Manton & Smith Co., 3333 W. Grand Av. 384
Reder Fdry. Co., 3536 S. Oakley Av. 394
Reuter Brothers, 5814 Wood St. 400
Scully Steel & Iron Co., 2364 S. Ashland 376
Simpson-Frisch Co., 1401 Wabansia Av. 388
Smith, F. P., W. & I. Wks., 2346 Clybourn 398
Sullivan-Korber Co., 2437 W. 21st Pl. 384
Union Fdry. Wks., 38 S. Dearborn St. 378
Vierling Steel Wks., 313 W. 23rd St. 400
Western Iron Const. Co., 4906 N. Clark 400
Weymer, E. M. Co., 1800 N. Francisco Av., 388
Woodbridge Orntl. Iron Co., 1519 Altgeld 372

IRON STORE FRONTS.

Butler St. Fdry. & Iron Co., 3424 Normal 398
Duffin Iron Co., 4837 S. Kedzie Av. 376
Federal Iron Wks., 30 N. La Salle St. 394
Halsted, Joseph, Co., 1233 W. Randolph 380
Hanke Iron & Wire Wks., 840 N. Albany 400
Holmes, Pyott & Co., 159 N. Jefferson 394
Manton & Smith Co., 1709 W. Austin Av. 384
Reder Fdry. Co., 3536 S. Oakley Av. 394
Reuter Brothers, 5814 Wood St. 400
Scully Steel & Iron Co., 2364 S. Ashland 376
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Simpson-Frisch Co., 1401 Wabansia Av. 388
Sullivan-Korber Co., 2437 W. 21st Pl. 384
Union Fdry. Wks., 38 S. Dearborn St. 378
Vierling Steel Wks., 313 W. 23rd St. 400
Western Iron Const. Co., 4906 N. Clark 400
Weymer, E. M. Co., 1800 N. Francisco Av. 388
Woodbridge Orntl. Iron Co., 1519 Altgeld 372

IRON WORK—ORNAMENTAL.

Bolter's, A. Sons, 2301 Ward St. 394
Butler St. Fdry. & Iron Co., 3424 Normal 398
Duffin Iron Co., 4837 S. Kedzie Av. 376
Federal Iron Works, 30 N. La Salle St. 394
Halsted, Joseph Co., 1233 W. Randolph 380
Hanke Iron & Wire Wks., 840 N. Albany 400
Holmes, Pyott & Co., 159 N. Jefferson St. 394
Manton & Smith Co., 3333 W. Grand Av. 384
Reuter Bros., 5814 Wood St. 400
Simpson-Frisch Co., 1401 Wabansia Av. 388
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Sullivan-Kerber Co., 2437 W. 21st Pl. 384
Union Fdry. Wks., 38 S. Dearborn St. 378
Vierling Steel Wks., 313 W. 23rd St. 400
Western Iron Const. Co., 4906 N. Clark 400
Weymer, E. M. Co., 1800 N. Francisco Av. 388
Woodbridge Orntl. Iron Co., 1519 Altgeld 372

IRON WORK—STRUCTURAL.

(See Structural Iron and Steel)

IRONING MACHINES (ELECTRIC)

Commonwealth Edison Co., 72 W. Adams 334
Troy Laundry Mchy. Co., 23rd & La Salle 544

JAIL AND PRISON BUILDERS.

Bolter's, A. Sons, 2301 Ward St. 394
Butler St. Fdry. & Iron Co., 3424 Normal 398
Halsted, Joseph Co., 1233 W. Randolph 380
Holmes, Pyott & Co., 159 N. Jefferson 394
Morava Constr. Co., 122 S. Michigan Av. 382
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Union Fdry. Wks., 38 S. Dearborn St. 378
Vierling Steel Wks., 313 W. 23rd St. 400

KALSOMINE.

Moore, Benj. & Co., 415 N. Green St. 542

KITCHENS—STEEL

Betz, Frank S. Co., 30 E. Rand. & Hammond, Ind., 68
Janows & Kramer Co., 640 W. Randolph 128

LABORATORY—TESTING.

Hunt, Robt. W. & Co., Ins. Ex. Bldg. 316

LAMPS, EXTERIOR—IRON AND BRONZE.

Halsted, Joseph Co., 1233 W. Randolph 380
Manton & Smith Co., 3333 W. Grand Av. 384
Reuter Bros., 5814 Wood St. 400
Simpson-Frisch Co., 1401 Wabansia Av. 388
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Sullivan-Korber Co., 2437 W. 21st Pl. 384
Weymer, E. M. Co., 1800 N. Francisco Av., 388
Woodbridge Orntl. Iron Co., 1519 Altgeld 372

LANDSCAPE ENGINEERS.

Peterson Nursery, 30 N. La Salle St. 74

LATH.

Pacific Lumber Co. of Ill., 332 S. Michigan 102

LATH—METAL AND WIRE.

Consolidated Expanded Metal Co., 562 W. Monroe St. 386
Goldsmith Metal Lath Co., 127 N. Dearborn St., 366
McCarthy, W. H., 133 W. Washington 310
North Western Expanded Metal Co., 407 S. Dearborn St. 368
Smith, F. P. W. & I. Wks., 2346 Clybourn 398
Voss, Frederick, 552 W. Monroe St. 402

LAUNDRY DRYERS.

Am. Laundry Mchy. Co., 208 W. Monroe 262
Troy Laundry Mchy. Co., 23rd & La Salle 544

LAUNDRY MACHINERY.

Am. Laundry Mchy. Co., 208 W. Monroe 262
Troy Laundry Mchy. Co., 23rd & La Salle 544

LAUNDRY TRAYS AND KITCHEN SINKS

Alberene Stone Co., 214 N. Clinton St. 486
Am. Laundry Mchy. Co., 208 W. Monroe 262
Clow, Jas. B., & Sons, 544 S. Franklin 490
Crane Co., 836 S. Michigan Av. 442-446
Kellogg Mackay Co., 419 W. 18th St. 432
Kohler Co., 332 S. Michigan Av., 494
Standard Sanitary Mfg. Co., 14 N. Peoria 492
Wolff Mfg. Co., 225 N. Hoyne Ave. 488

LEAD BURNING.

Gustafson, K. A., 2114 N. Springfield 484
Hayward, R. B., Co., 849 W. Ohio St. 484
Mellish-Hayward Co., 213 W. Austin Av. 484
Nacey, P., Co., 927 S. State St. 98

LIABILITY INSURANCE.

Builders & Mfgrs. Mutual Casualty Co., 133 W. Washington St. 42
Sherman & Ellis, Inc., 11 S. La Salle St. 268

LIGHTING FIXTURES.

Brascolite Co., 108 S. La Salle St., 326
Central Electric Co., 320 S. Wells St. 350
Commonwealth Edison Co., 72 W. Adams 334
Everson, C. G., & Co., 70 W. Lake St. 350
Frink, I. P., Inc., 53 W. Jackson Blvd. 330
Moran & Hastings Mfg. Co., 16 W. Washington 332
Pearlman, Victor S., & Co., 533 S. Wabash Ave. 318
Reflectolyte Co., 914 Pine St., St. Louis, Mo. 328

LIGHTNING RODS

Arrow Conductor Co., 1536 W. Adams 398
Shinn, W. C. Mfg. Co., 14 E. Jackson Blvd., 392

LIME.

Consumers Co., 111 W. Washington 56
Rosing, Astrid S., 111 W. Monroe St. 28

Johns-Manville Co., 18th & Michigan 8
Lehon Co., 44th & Oakley Ave. 88
Moore, Edw., Rfg. Co., 2729 W. Madison 92
Servicised Products Co., 38 S. Dearborn 96
Watson, H. F. Co., 5231 S. Western Av. 308

ROOFING PAPER.

Amalgamated Rfg. Co., 431 S. Dearborn 264
Barrett Co., 10 S. La Salle St. 26
Bird & Son, 1472 W. 76th St. 22
Cent. Asbestos & Mag. Co., 214 W. Grand 428
Ford Rfg. Products Co., 111 W. Wash. 94
Ill. Fire Proof Cov. Co., 216 W. Kinzie St. 424
Johns-Manville Co., 18th & Michigan 8
Krez, Paul J., Co., 414 N. La Salle St. 126
Lehon Co., 44th & Oakley Ave. 88
Moore, Edw., Rfg. Co., 2729 W. Madison 92
Servicised Products Co., 38 S. Dearborn 94
Standard Asbestos Mfg. Co., 816 W. Lake 430
Watson, H. F. Co., 5331 S. Western Av. 308

ROOFING TILE.

Federal Cement Tile Co., 110 S. Dearborn 16
Ludowici-Celadon Co., 104 S. Michigan 90

ROPE TRANSMISSION MACHINERY.

Altizer Elevator Mfg. Co., 1895 Milwaukee Av. 114
Chgo. Pulley & Shafting Co., 32 S. Clinton 58
Elevator Co. of Am., 190 N. State St. 110
Kaestner & Hecht Co., 500 S. Throop St. Inside Back Cover
Olson, Samuel, & Co., 2418 Bloomingdale 14
Otis Elevator Co., 600 W. Jackson Bl. 106
Pitt Engineering Co., 120 W. Kinzie 108
Wheeler Elevator Co., 1100 Washington 112
Weller Mfg. Co., 1856 N. Kostner Av. 80

RUGS AND CARPETS—ORIENTAL AND DOMESTIC.

Pick, Albert & Co., 212 W. Randolph 6

SAND AND GRAVEL.

Brownell Improve. Co., 133 W. Wash. 310
Consumers Co., 111 W. Washington 56
Dee, Wm. E., Co., 30 N. La Salle St. 310
Janesville Sand & Gravel Co., 111 W. Monroe St. 310
Rosing, Astrid S., 111 W. Monroe St., 28

SASH, DOORS AND BLINDS.

Chgo. Sash, Door & Blind Mfg. Co., 1249 W. North Av. 278
Curtis Door & Sash Co., 1414 S. Western 160
Morgan Sash & Door Co., 2287 Blue Island Av. Inside Front Cover
Morris, Wm. & Son Co., 1000 W. 50th St. 278
Nollau & Wolff Mfg. Co., 1705 Fullerton 316

SASH OPERATORS.

Casement Hardware Co., 232 E Ohio St. 274
Dean, Olney J., & Co., 179 W. Wash. 402
Detroit Steel Prod. Co., 111 W. Wash. 30
Lawson Mfg. Co., 228 W. Superior St. 84-86
Lupton, David, Sons Co., 28 E. Jackson 36
Midwest Hardware Co., 56 W. Randolph 60
Monarch Metal Products Co., 5020 Penrose St., St. Louis Mo. 62

SASH—STEEL.

Dean, Olney, J. & Co., 179 W. Wash 402
Detroit Steel Products Co., 111 W. Washington 30
Lupton, David, Sons Co., 28 E. Jackson 36

SCAGLIOLA.

Kalteux, Nic., 15 E. Van Buren St. 358

SCALE MODELS OF BUILDINGS.

Architectural Dec. Co., 1600 S. Jefferson 544
Dux, Joseph, 2112 W. Van Buren St. 544

SCHOOL FURNITURE.

Rowles, E. W. A., Co., 2345 S. La Salle 640

SCREENS—WINDOW AND DOOR.

Chamberlin Metal Weather Strip Co., 626 S. Dearborn 268
Sager Metal Weather Strip Co., 162 W. Austin 78

SCUPPERS & FLOOR DRAINS.

Dean, Olney, J., & Co., 179 W. Wash. 402

SECURITY BONDS FOR CONTRACTORS.

Builders & Mfgrs. Mutual Causalty Co., 133 W. Washington St. 42
Sherman & Ellis, Inc., 11 S. La Salle St. 268

SEATING—PUBLIC BUILDINGS.

Rowles, E. W. A., Co., 2345 S. La Salle 640

SEPARATORS STEAM AND OIL.

Webster, Warren & Co., 53 W. Jackson 482

SEATS—CLOSET.

Brunswick-Balke-Collender Co., 623 S. Wabash Av. 504

SELF CLOSING COCKS.

Imperial Brass Mfg. Co. 1200 W. Harr. 498

SEWER PIPE.

Dee, Wm. E., Co., 30 N. La Salle St. 310
Rosing, Astrid S., 111 W. Monroe St. 28

SEWER WORK.

Nacey, P., Co., 927 S. State St. 98

SEWAGE EJECTORS AND BILGE PUMPS.

Chicago Pump Co., 2336 Wolfram St. 454
Wade Iron Sanitary Mfg. Co., 551 Fulton 514
Yeomans Bros., 1432 Dayton St. 486

SHADE EQUIPMENT FOR INDUSTRIAL BUILDINGS.

Shurlox Awning & Shade Co., 561 W. Monroe St. 4
Walger Awning Co., 561 W. Monroe St. 4

SHEET METAL WORKS.

Genl. Ventilating & Mfg. Co., 6008 S. State St. 458
Gordon, Robt., Inc., 1355 W. Washington 472
Gustafson K. A., 2114 N. Springfield 484
Haines Co., 1933 W. Lake St. 460
Hayward, R. B. Co., 849 W. Ohio St. 484
Mellish-Hayward Co., 213 W. Austin Av. 484
Monarch Vent. Co., 1338 Sedgwick 456
Narowetz Heat. & Vent. Co., 1711 Park Av. 460

SHELVES—STEEL FOR FACTORIES.

Durand Steel Locker Co., 76 W. Monroe 18
Federal Steel Fixture Co., 4545 Homer 64

SHINGLES.

Pacific Lumber Co. of Ill., 332 S. Michigan 102

SHINGLES—FIREPROOF.

Amalgamated R'fg. Co., 431 S. Dearborn 264
Am. Tar Products Co., 208 S. La Salle 272
Barrett Co., 10 S. La Salle St. 26
Beckman Dawson Rfg. Co., 19 S. La Salle 308
Bird & Son, 1472 W. 76th St. 22
Ford Roofing Products Co., 111 W. Wash. 94
Ill. Fire Proof Cov. Co. 216 W. Kinzie St. 424
Johns-Manville Co., 18th & Michigan 8
Lehon Co., 44th & Oakley Ave. 88
Servicised Products Co., 38 S. Dearborn St. 96
Watson, H. F. Co., 5331 S. Western Av. 308

SHINGLE STAINS.

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